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The Engineer.

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The Engineer

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PUBLIC NOTICES

The Director-General,
India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for :—
5 LOCOMOTIVE BOILERS, 2ft. 6in. gauge.
Tenders due 28th February, 1930.
Forms of Tender available from the above at a fee of 5s., which will not be returned. 4408

Crown Agents for the COLONIES.
COLONIAL GOVERNMENT APPOINTMENTS.
APPLICATIONS from qualified candidates are INVITED for the following POST :—
M/1740.—ASSISTANT HARBOUR ENGINEER REQUIRED by the GOVERNMENT of the GOLD COAST for the Takoradi Harbour, for a tour of 12 to 18 months' service. Salary £480 a year for the first three years of service and then £510, rising to £720 by annual increments of £30 and thence to £920 a year by annual increments of £40. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, age 25 to 35, must have passed "A" and "B" of the examinations to qualify for the A.M.I.C.E. Diploma or hold professional qualifications recognised by the Institution of Civil Engineers as exempting from those examinations. Should have had some civil engineering experience outside pupilage, preferably on Harbour and Dock Works.
Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/1740. 4407

In the Matter of LETTERS PATENT granted to ANTOINE FRANCE and PAUL HABETS bearing date the 4th October 1912 and numbered 22,655 of 1912 for the invention of "Improvements in Apparatus for Washing Coal and other Minerals" and LETTERS PATENT of ADDITION thereto numbered 5519 of 1913 and 104,132, LETTERS PATENT granted to PAUL HABETS and ANTOINE FRANCE bearing date the 5th March 1913 and numbered 17,010 of 1913 for the invention of "Improvements in or relating to Nozzles or Mouthpieces for Apparatus for Washing Coal and other Minerals." LETTERS PATENT granted to PAUL HABETS and ANTOINE FRANCE bearing date the 24th July 1913 and numbered 17,011 of 1913 for the invention of "Improvements in Apparatus for Washing Coal and other Minerals," LETTERS PATENT granted to PAUL HABETS and ANTOINE FRANCE bearing date the 26th July 1913 and numbered 15,689 of 1914 for the invention of "Improvements in Methods of and Apparatus for Washing Coal and other Minerals," and LETTERS PATENT granted to ANTOINE FRANCE bearing date the 3rd August 1915 and numbered 11,217 of 1915 for the invention of "Improvements in Wet Sorting Apparatus," and LETTERS PATENT of ADDITION thereto numbered 142,735.

Notice is Hereby Given that on the 11th March 1930 an ORIGINATING SUMMONS (1929 F. No. 1117) issued out of the High Court of Justice, Chancery Division, on behalf of Antoine France (the Patentee), asking that the term of the said Patents may be extended for a further period of five years in each case, will come before Mr. Justice Luxmoore for Directions as to the hearing, and any person desirous of being heard in opposition must at least seven days before that date lodge notice of opposition (giving an address for service within the United Kingdom) at Room 175, Royal Courts of Justice, Strand, London, and serve a copy thereof upon the undermentioned Solicitors.
Dated the 5th day of February, 1930.
DENTON, HALL and BURGIN,
3, Gray's Inn-place, Gray's Inn, W.C. 1,
upon whom all documents requiring service should be served. 4394

Armstrong College.
NEWCASTLE-UPON-TYNE.
(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.Sc. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.

The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.

Full particulars of the Courses may be had on application to

THE REGISTRAR,
Armstrong College,
3708 Newcastle-upon-Tyne.

Administrative County of LONDON.
The London County Council invites TENDERS for the REMOVAL and DISPOSAL (during alternative periods of one year and three years respectively from 1st April, 1930) of the FURNACE ASHES from the Woolwich Ferry Steamboats.
Instructions for Tender, form of Tender, &c., may be obtained on application to the Chief Engineer, the Old County Hall, Spring-gardens, S.W. 1, upon payment of £1 by cheque, draft or money order to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application, and the contract documents may be inspected before payment of the fee.
Remittances by post should be addressed to the Chief Engineer, the Old County Hall, Spring-gardens, S.W. 1. Personal inquiries at Room 3A, No. 3, Warwick House-street, Cockspur-street, S.W. 1.
The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in "The London County Council Gazette."
No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 24th February, 1930, will be considered.
The Council does not bind itself to accept the lowest or any Tender.
MONTAGU H. COX,
4373 Clerk of the London County Council.

PUBLIC NOTICES

THE
LONDON ASSOCIATION OF FOREMEN ENGINEERS
ESTABLISHED 1852.
FOREMEN, MANAGERS and EMPLOYERS connected with the Engineering Industry.

Seventy-seventh Anniversary Festival

SATURDAY, MARCH 1st, 1930.

CHAIRMAN:
JOHN WEIR, ESQ., M.I.M.E.

Tickets 15/- each.

Apply on or before February 19th, to SECRETARY: W. ROBINSON, 132a, ADELAIDE ROAD, BROCKLEY, S.E. 4.
P 6659

Edinburgh Corporation.
ELECTRICITY SUPPLY.
The Edinburgh Corporation has FOR SALE for immediate release ONE British Thomson-Houston 5000-kW, 6600-volt, three-phase, 3000 r.p.m. TURBO-ALTERNATOR, suitable for a steam pressure of 200 lb. per sq. in., and complete with the following :—Jet Condensing Plant, by Messrs. Hick, Hargreaves; Electrically Driven Circulating Pump. One Spare Exciter Armature, One Spare Pump Armature, One Set of Bearings, One Tirrell Regulator.
The plant was purchased in 1919 and has had very little use. Price £2000. Further particulars from the undersigned.
EDWIN SEDDON,
Engineer and Manager.
Dewar-place, Edinburgh,
February 3rd, 1930. 4359

PUBLIC NOTICES

City of Leicester.
TO BOILERMAKERS, ENGINEERS AND OTHERS.
BOILER-HOUSE PLANT FOR ISOLATION HOSPITAL, GROBY-ROAD, NEAR LEICESTER.
TENDERS are INVITED for PROVIDING and FIXING TWO 9ft. by 30ft. LANCASHIRE BOILERS, ECONOMISERS, FEED PUMPS, HOT and COLD WATER TANKS, PIPE CONNECTIONS, VALVES, &c.
Forms of Tender, drawings, and other particulars may be obtained from the undersigned on payment of £2, which will be returned upon receipt of a bona fide Tender.
Cheques, &c., to be made payable to the City Treasurer, Town Hall, Leicester, and crossed.
Tenders, in a sealed envelope, endorsed "Tender for Boiler Plant at Isolation Hospital," are to be addressed to "The Chairman of the Health Committee" and delivered to the City Surveyor's office before Noon on Wednesday, 26th February, 1930.
The Corporation does not bind itself to accept the lowest or any Tender.
A. T. GOOSEMAN, M. Inst. C.E.,
City Engineer and Surveyor.
Town Hall, Leicester,
January, 1930. 4355

City of Liverpool.
OTTERSPOOL IMPROVEMENT SCHEME.
CONSTRUCTION OF RIVER WALL.
CONTRACT NO. 1.
The Corporation are prepared to receive TENDERS for the COMPLETION of the above-mentioned WORKS, in accordance with plans and specification prepared by the City Engineer.
The plans may be inspected and specification, bills of quantities and form of Tender obtained upon application at the City Engineer's Dept., Municipal Buildings, Dale-street, Liverpool, between the hours of 9 a.m. and 5 p.m., on payment of a deposit of £3 3s. to the City Treasurer, which amount will be refunded provided a bona fide Tender is submitted and not subsequently withdrawn.
The Corporation do not bind themselves to accept the lowest or any Tender.
Tenders must be enclosed in the official envelopes provided, sealed and endorsed "Tender for River Wall, Otterspool Improvement Scheme," and forwarded through the post, addressed to :—
The Town Clerk,
Municipal Buildings, Liverpool.
Latest time and date for receipt of Tenders Ten o'clock a.m. on Monday, 24th February, 1930.
WALTER MOON,
Town Clerk.
22nd January, 1930. 4282

PUBLIC NOTICES

Belfast Harbour.
The Belfast Harbour Commissioners are prepared to receive TENDERS for the CONSTRUCTION of a REINFORCED CONCRETE CULVERT with BRICK MANHOLES, &c. (total length about 376ft.), to carry the Milewater through the Timber Pond and adjoining land near Duncrue-street, Belfast, all in accordance with drawings which may be seen at the office of the Harbour Engineer, Mr. T. S. Gilbert, M. Inst. C.E., from whom copies of the conditions of contract, specification, and form of Tender may be obtained.
Tenders must be made on the form provided for the purpose, and must be enclosed in a sealed envelope, endorsed "Tender for Culvert," addressed to the undersigned, and delivered not later than Monday, the 17th February, 1930.
The Commissioners do not bind themselves to accept the lowest or any Tender.
M. J. WATKINS,
General Manager and Secretary.
Harbour Office, Belfast,
3rd February, 1930. 4390

South Indian Railway COMPANY, LIMITED.
The Directors are prepared to receive TENDERS for the SUPPLY of :—
1. LINOLEUM.
2. SPARE PARTS for TRAIN LIGHTING CELLS (WOOD SHEET SEPARATORS).
3. ENAMELLED IRON STATION NAME PLATES.
Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.
Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Linoleum," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 21st February, 1930.
The Directors do not bind themselves to accept the lowest or any Tender.
A charge, which will not be returned, will be made of 5s. for each copy of the Specifications Nos. 1 and 2, and of 2s. 6d. for each copy of Specification No. 3.
Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.
A. MUIRHEAD,
Managing Director.
91, Petty France, Westminster, S.W. 1,
5th February, 1930. 4406

TO LAUNDRY CONTRACTORS.
The Coventry Board of GUARDIANS are prepared to receive TENDERS for the SUPPLY and INSTALLATION of LAUNDRY MACHINERY at their London-road Institution, in accordance with plans and specification prepared by their Consulting Engineers, Edwards and Shaw, 105, Colmore-row, Birmingham.
Conditions of contract, specification, and form of Tender will be supplied by me upon application being made, accompanied by a deposit of Three Guineas, which sum will be returned upon receipt of a bona fide Tender, sealed and endorsed "Tender for Laundry," and forwarded to reach me not later than the first post on Wednesday, 26th February, 1930.
The Guardians do not bind themselves to accept the lowest or any Tender.
E. A. EVANS,
Clerk to the Guardians.
13, Little Park-street, Coventry,
3rd February, 1930. 4387

Tyne Improvement Commission
40-TON TITAN CRANE.
The Tyne Improvement Commissioners are prepared to receive TENDERS for ONE 40-TON TITAN CRANE for the North Pier, Tynemouth.
Copies of the form of Tender, conditions of contract and specification may be obtained on application to the undersigned, on payment of a deposit of £3 3s., which sum will be returned on receipt of a bona fide Tender.
Tenders, in sealed envelopes, endorsed "Tender for Titan Crane," and addressed to "The Chairman, Tyne Improvement Commission, Newcastle-upon-Tyne," must be delivered at the undermentioned office not later than Wednesday, the 5th March, 1930.
The Commissioners do not bind themselves to accept the lowest or any Tender.
By Order,
ALBERT BLACKLOCK,
Secretary.
Tyne Improvement Commission Offices,
Bewick-street, Newcastle-upon-Tyne,
4th February, 1930. 4357

Borough of Weymouth and MELCOMBE REGIS.
DREDGING FOREMAN REQUIRED, to Take Charge of 10in. Suction Cutter Dredger at Weymouth. Previous experience of similar work essential.
The engagement will commence as soon after the applications have been received as possible, and the appointment will be subject to one month's notice on either side. The first three months of the appointment will be considered as probationary.
Applications, accompanied by full particulars of experience, wages required, and copies of recent testimonials, to be sent to the TOWN CLERK, Municipal Buildings, Weymouth, on or before the 17th February.
Weymouth,
5th February, 1930. 4399

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For Advertisement Rates see Leader Page.

PUBLIC NOTICE

ROYAL SHOW

MANCHESTER

July 8th to 12th, 1930.

EXHIBITION OF IMPLEMENTS, &c.

The Regulations and Forms of Application for Space are now ready.

Applications for space must be made by

Thursday, March 20th, 1930

ENTRIES for Silver Medals close March 1st.

Live Stock, Produce and Forestry entries close on MAY 20th; Flower Show on MAY 23th; Poultry and Butter Making Competitions on MAY 31st; Cider, Plantations, Home Nurseries, Orchards and Fruit Plantations on MAY 1st.

T. R. TURNER, Secretary.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND,
16, Bedford Square, London, W.C.1.

Bombay, Baroda and Central INDIA RAILWAY.

APPLICATIONS are INVITED by letter only for the POST of ELECTRICAL (TRACTION) ENGINEER for service on the above Railway. The Bombay Suburban Section operated by electric traction is about 26 route miles in length and the equipment comprises 40 four-coach trains operating at 1500 volts D.C., 3 rotary converter sub-stations and the overhead track equipment.

The successful candidate must have had sufficient experience to enable him efficiently to take charge of the operation and maintenance of the foregoing equipment.

The appointment is on the permanent staff of the Railway and the agreement in the first instance will be for three years, extensible by mutual consent.

SALARY.—The salary will depend upon the candidate's age and qualifications, but will be approximately Rs. 1150 per month, plus £30 per month "overseas pay," plus "Bombay allowance" of Rs. 135 per month. The salary is payable from the date of departure from this country. Provident Fund, gratuity and leave will be in accordance with the rules applicable to the Company's officers. A free first-class passage to India and a return passage on the termination of the agreement are provided.

The selected candidate will be required to pass a strict medical examination and should preferably be not less than 25 years of age or more than 45.

Applications should give full details of education and career to date, stating age, salary required, and whether married or single.

Applications, accompanied by copies only of testimonials, should be addressed to Messrs. MERZ and PARTNERS, 32, Victoria-street, London, S.W. 1, not later than 21st February, 1930. 4354

Jodhpur Railway.

An ASSISTANT LOCOMOTIVE SUPERINTENDENT is REQUIRED for service on the Jodhpur Railway, India. Age should be about 25 years and applicants should be unmarried.

Candidates must have received their general education at a "Public" School, and should have had a good technical training, preferably at a recognised Engineering College, in addition to having served a proper apprenticeship in some well-known locomotive shops, either those of a British Railway or Locomotive Builder, together with drawing-office and running department experience.

SALARY.—About Rupees 525 per calendar month, or according to age and qualifications, with annual increments of Rs. 50 per month, in accordance with Government scale; first-class free passage out and home again on satisfactory termination of service. The appointment will be on a three years' agreement in the first instance. To a properly qualified man of suitable age the railway would be willing to pay up to Rupees 625 per calendar month to commence, which would carry with it two years' seniority. In this case both the public school education and the holding of a degree are essential.

There will be a strict medical examination before appointment, and applicants should ascertain whether their teeth and general health are satisfactory before applying, in order to save trouble to all parties.

Applications may be made by letter only, and candidates must give therein full particulars of their career, stating their age and giving list of departments where apprenticeship was served, together with short details of work performed, and length of time in each department, also particulars of subsequent experience, &c.

Letters must be addressed to the undersigned, accompanied by COPIES of testimonials, &c., not later than 28th February, 1930.

RENDEL, PALMER & TRITTON,
Appointments Department,
7377 55, Broadway, London, S.W. 1.

Karachi Port Trust.

NOTICE.

1. The Trustees of the Port of Karachi invite APPLICATIONS for the POST of DEPUTY CONSERVATOR.

2. An applicant must be about 40 years of age, and
(A) have a thorough knowledge of Marine Survey,
(B) be experienced in handling ships, and
(C) possess a Board of Trade Master's Certificate or the equivalent in the Royal Navy or Royal Indian Marine.

3. Pay Rs. 1250 p.m., rising by annual increments of Rs. 50 for approved service to a maximum of Rs. 1600 p.m., with a conveyance allowance of Rs. 150 p.m. The successful candidate may, however, be granted such rate of pay within this grade as the Trustees may consider suitable for his qualifications and experience.

4. The appointment is not pensionable, but the successful candidate will be required to subscribe to the Trustees' Provident Fund, in the benefits of which under their rules he will participate. Leave and leave salary and passage benefits will be given under the Trustees' rules in force from time to time.

5. The selected candidate will be on probation for six months. If confirmed, he will be required to enter into a five years' agreement (including the probationary period), which may be renewed at the discretion of the Board.

6. Applications, with references, copies (which will not be returned) of testimonials, and a recent photograph, and stating nationality, parentage, age, career, educational and other qualifications, and giving detailed particulars of experience, and stating what starting pay is expected within the above grade, to be addressed to Messrs. RENDEL, PALMER and TRITTON, 55, Broadway, Westminster, London, S.W. 1, so as to reach them on or before 17th February, 1930, the outer cover being endorsed "Appointment of Deputy Conservator."

7. The selected candidate will be paid first-class railway and steamer fares to Karachi, in accordance with the Subsidiary Rules of Government framed under Rule 44 of the Fundamental Rules.

J. B. S. THUBRON,
Chairman.
January, 1930. 4376

PUBLIC NOTICES

COIMISIUN NA STAT-SHEIRBHISE.

POSITION VACANT—EXAMINER OF APPLICATIONS FOR PATENTS OF INVENTIONS.

The Civil Service Commissioners invite APPLICATIONS for the whole-time, permanent, pensionable POSITION of EXAMINER of APPLICATIONS for PATENTS of INVENTIONS (chiefly Chemical) in the Industrial and Commercial Property Registration Office, Department of Industry and Commerce. Salary scales: married man, £150-£400; woman or unmarried man, £120-£300 a year, plus cost-of-living bonus in each case. At present the bonus on £150 is £88 16s., and on £120 is £78 8s. A candidate of approved experience or exceptional chemical qualifications may, in certain circumstances, be allowed to enter the scale at a point above the minimum but not above £200 in the case of a married man, and not above £157 10s. in the case of a woman or unmarried man. Good general education, particularly in Science and Mathematics, and a knowledge of Industrial Chemistry required. Age limits 24 to 40 years on 1st February, 1930.

Latest date for receiving applications 19th February, 1930. Forms and particulars may be obtained from the SECRETARY, Civil Service Commission, 45, Upper O'Connell-street, Dublin, C. 8. 4405
I.B. 1303. W. H. Co.

The Lancashire Electric Power COMPANY.

The above Company has a VACANCY for an ASSISTANT ENGINEER in their Combustion and Testing Department. Applicants must have a sound theoretical knowledge of Steam Engineering and the Testing of Turbine and Boiler Plant, and some knowledge of Chemistry would be an advantage. Salary in accordance with age and experience.

Applications should be sent as soon as possible to THE RESIDENT ENGINEER,
Kearsley Power Station,
4385 Stoneclough, near Manchester.

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

BOX P6592 DESIRES to THANK all APPLICANTS and to state the POSITION is now FILLED. 4372 A

WANTED, ASSISTANT SUPERINTENDENT, Experienced as Master Mechanic, French speaking, for new factory in Paris. Preferably one with draughting experience and a knowledge of Machine Shops and Foundry, both ferrous and non-ferrous.—Apply by letter, with full particulars, CRANE-BENNETT, Ltd., Employment Department, Leman-street, London, E. 1. 4358 A

WANTED by an Engineering Firm in the East Midlands, a competent CONSTRUCTIONAL ENGINEER as Chief Assistant in Drawing-office of large Boiler Works. Applicants must have first-class experience in the design of all types of Boilers, Tanks, and Constructional Steel Work.—Address, stating qualifications, experience, age, and salary required, 4374, The Engineer Office. 4374 A

WANTED, by London Firm of Engineers' Merchants, Smart REPRESENTATIVE for Sale of good Specialities. Good salary, commission and expenses and car provided for right man, who would be willing to invest not less than £500 in business, which would be guaranteed.—Address, 4334, The Engineer Office. 4334 A

WANTED, CHEMICAL ENGINEER, with Experience in Gasworks Practice and conversant with latest developments in the gas industry. Knowledge of the design of Gas, Chemical and Coke Oven Plants essential. Preference will be given to applicant having an engineering or science degree.—Apply, giving particulars of experience, &c., and salary required, to MANAGING DIRECTOR, Wheesoe Foundry and Engineering Company, Limited, Darlington. 4383 A

WANTED, First-class TECHNICAL and COMMERCIAL ENGINEER, to take up position in India about end of 1930, as Head Representative in charge of office of well-known British Engineering and Boilermaking concern. Age about 35, preferably public school man. Replies will be treated in confidence and should embody full qualifications, practical and education. Only those with Turbine and Boilermaking experience will be considered.—Address, 4366, The Engineer Office. 4366 A

WANTED, SMART MAN in Machine Tool Business. For one who has workshop and drawing-office experience and is prepared to work this is an exceptional opportunity.—Address, 4368, The Engineer Office. 4368 A

ALFRED HERBERT, Ltd., Have VACANCY for MAN with works training, able to lay out machining operations and calculate production times.—Applications in writing to CHIEF EQUIPMENT ENGINEER, Alfred Herbert, Ltd., Coventry. 4369 A

ASSISTANT FOUNDRY MANAGER REQUIRED. Must be used to up-to-date methods and mechanical handling of materials.

Knowledge of the Motor Trade essential.

Write, giving full particulars of experience, age, and salary required, to Box 734, Dorland, 14, Regent-street, S.W. 1. P6665 A

CHIEF METALLURGIST REQUIRED for Aero-engine Work. Experienced in dealing with material failures. Capable of advising on new materials and processes. Responsible position for fully qualified man.—Address, 4370, The Engineer Office. 4370 A

CONSTRUCTIONAL STEEL WORK DESIGNER REQUIRED for London Consulting Engineer's Office.

State experience and salary expected.
Address, P6668, The Engineer Office. P6668 A

ELEVATING and CONVEYOR WORKS MANAGER REQD., London. Practical man with estimating exp. Age 32/40. Sal. up to £500 p.a., according to exp.—Apply, LAURIE and CO., Employment Specialists, 28, Basinghall-st., E.C. No preliminary fee. 4404 A

ENGINEER or METALLURGIST SALESMAN, to control London office of important British company marketing special alloys. A wide knowledge of technical industry with first-class education and address essential; progressive position; good salary with bonus on development. Only applicants stating full details of general and technical education and experience can be considered.—Address, "TECHNICAL," Wm. Porteous and Co., Advertising Agents, Glasgow. P6602 A

ENGINEER SURVEYORS, Senior and Junior, WANTED for a Triangulation, Tacheometrical and Hydrographical Survey abroad. Sterling salary plus local living allowance.—State age, experience, and salary to Box 519, c/o Brown's, 59, Tothill-street, S.W. 1. 4396 A

EXPERT RATE FIXER WANTED. Must be thoroughly experienced in Steam Turbine and Electrical Generator Manufacture.—Address, stating age, experience, and whether used to electrical windings also, and salary required, 4384, The Engineer Office. 4384 A

FIRM Making Heavy Engineering Equipment REQUIRES the SERVICES of a first-class MAN to Take Charge of Inspection Department controlling both departmental inspection in shops and inspection of finished machines.—Write, giving full particulars of experience and stating age, Box 524, A. W. Brown, 39, Tothill-street, S.W. 1. 4398 A

FULLY Qualified ELECTRICAL ENGINEER with mechanical experience REQUIRED by a Firm manufacturing Excavating Machinery and other Heavy Equipment. Must be up to date.—Write, giving age and full particulars, Box 523, A. W. Brown, 39, Tothill-street, S.W. 1. 4397 A

JUNIOR SALES and ESTIMATING ASSISTANT WANTED for Engineering Works, South Coast. Knowledge of Engineering Publicity Work essential. State age, salary, and experience.—Address, 4400, The Engineer Office. 4400 A

SITUATIONS OPEN (continued)

LARGE CONCERN, with Many Branches, REQUIRES for important administrative and executive post an ENGINEER with works experience and sound chemical knowledge. Age about 40. Salary entirely depends on capacity. Only first-class men need apply.

Address fully, 4378, The Engineer Office. 4378 A

OLD-ESTABLISHED BUSINESS (Engineers) has VACANCY for ACTIVE DIRECTOR, A.R.S.M. or M.I.C.E., with Colonial experience in Water or Public Works Undertakings preferred. Give full details of experience and age. References exchanged and full investigation. Shares available from deceased member.—Write, "Z.B.," c/o Street's, 6, Gracechurch-street, E.C. 3. 4381 A

WORKS ENGINEER (MECHANICAL) for Factory in Lancashire. Duties, supervision of maintenance staff, responsible for running of plant, power-house, experience on A.C. distribution and equipment essential.

State experience, qualifications, salary required, age, and when available.
Address, P6673, The Engineer Office. P6673 A

WORKS MANAGER as Assistant to a Director of Yorkshire Engineering Works employing about 300 men, conversant with latest Shop Practice for Non-repetition Work, able to get best results out of machines and men under his control; wide workshop experience, agreeable personality essential. Age 28/42 Commencing salary £500 to £600 per annum.—Address, giving references, 4306, The Engineer Office. 4306 A

WANTED, DRAUGHTSMAN, Used to Steel Structural Work, General Engineering, Coal and Coke Handling Plants for Gas Works, for West of England.—Address, stating age, qualifications, and salary required, 4367, The Engineer Office. 4367 A

WANTED, 2 or 3 DRAUGHTSMEN with some experience on Machine Tool Work (experience in Jig and Tool Work is not sufficient).—Address, stating age, experience and salary required, 4300, The Engineer Office. 4300 A

CHIEF DRAUGHTSMAN REQUIRED in Works having about 900 employees engaged in the manufacture of intricate, accurate machinery. Must possess proved organising ability.—Address, stating age, experience, and wages required, 4271, The Engineer Office. 4271 A

DRAUGHTSMAN.—ELECTRICAL ENGINEERS in the Midlands have VACANCY for experienced SENIOR DRAUGHTSMAN possessing sound knowledge of Mechanical Design of large capacity High Voltage Transformers.—Address, giving particulars of experience, age and salary required, 4304, The Engineer Office. 4304 A

DRAUGHTSMAN for Designs of Lathes; Initiative and experience essential.—Write, HOLBROOK, 44, Martin-street, Stratford, London, E. 4260 A

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Scientific and Industrial Research.

A SUMMARY of the report for 1928–29 issued by the Department of Scientific and Industrial Research will be found elsewhere in this issue. In addition to the information there given, we may here record that the gross expenditure of the Department during the year was £661,365, its receipts £175,915, and its net expenditure £485,450. The heaviest item of gross expenditure was the £195,164 required to run the National Physical Laboratory. The Laboratory, however, earned receipts valued at £105,303. Even so, the net expenditure on it—£89,861—is the highest item of net expenditure incurred by the Department. Next to the Laboratory, the most expensive section under the control of the Department was the Fuel Research Station, on which a gross total of £84,796 was expended and from which receipts of only £6919 were forthcoming. The Geological Survey and Museum came third with a gross expenditure of £66,161 and receipts of only £879. It is of interest to observe that of the receipts credited to the National Physical Laboratory, £64,044 were received from outside bodies and firms, £29,031 from the Air Ministry, and £5737 from other Government Departments. In words, therefore, the Air Ministry is responsible for more than a quarter of the Laboratory's receipts. There are now 24 research associations in existence. The ages of these bodies range from 11 to 3 years. Since their formation these bodies have received from the Departments grants totalling £609,790. Of the maintenance grants made to students in training we have to record this year a fall in all sections of study, except engineering. Grants to students of chemistry still stand at the head of the list with 55, but in the previous year grants were made to 82 students, while in 1926–27, 91 chemistry students were assisted. To 11 students of physics grants were made last year, as compared with 27 in the preceding year. Engineering students to the number of 10 received allowances, exactly the same number as those helped in each of the two previous years. In biology the number of grants to students fell from 16 to 8, in mathematics and astronomy there was substantially no change, with 8 students in receipt of grants as compared with 7 and 9 in the two preceding years. In metallurgy the grants fell in number from 5 to 2, and in geology and mineralogy from 2 to 1.

The Dartford-Purfleet Tunnel.

THE Bill promoted by the Kent and Essex County Councils and backed by the Government for the construction of a tunnel beneath the Thames to connect Dartford and Purfleet came up for second reading in the House of Commons on Wednesday. On Monday representatives of the Port of London Authority attended a meeting of members of Parliament and pointed out that the depth at which it was proposed to construct the tunnel was insufficient to avoid danger to it from shipping, and was such as to make the tunnel a menace to the development of the river. Mr. Thomas Wiles, Chairman of the Authority's Law and Parliamentary Committee, explained that the Bill provided for the construction of a tunnel at a depth of 42ft. 9in. from its crown to the level of low water of ordinary spring tides. There would therefore, he said, be a depth of only 12ft. 9in. from the crown to the bed of the river. In addition, power was sought for an upward deviation of the tunnel by 10ft., which would bring the crown only 2ft. 9in. below the bed of the river. The site proposed for the tunnel was a recognised anchoring area for vessels having a draught of 30ft. and upwards when waiting for the tide to proceed up the river. There was, therefore, a grave possibility that the anchors of such vessels might encounter the tunnel. In addition, the Authority was advised that in the near future it would have to be prepared to deal with vessels drawing 60ft. of water and therefore requiring a depth of 65ft. to 70ft. If the tunnel were constructed at the proposed depth it would constitute an obstacle to dredging the channel to the requisite depth. Sir John Biles stated that ships of 40ft. draught were already in service and that draughts of 60ft. were not at all improbable in the near future. Mr. Palmer said that he could see no engineering difficulty in the way of constructing the tunnel at an increased depth, although to do so would involve extra expense in lengthening the approaches. It was resolved that the Minister of Transport should be approached with a view to the insertion in the Bill of an instruction to the effect that the depth of the tunnel should be increased sufficiently to meet the difficulties raised by the deputation.

An Interesting L.M.S. Appointment.

MUCH interest has been aroused this week by the announcement that Sir Harold Hartley has been appointed a Vice-President of the London, Midland and Scottish Railway and is to serve in the capacity of Director of Scientific Research. Sir Harold, it is intimated, will act in conjunction with an advisory council of scientists, of which he will be chairman. His activities will cover the chemical, metallurgical, and physical aspects of the railway company's work and will extend to the civil, marine, mechanical, signal, telegraph, and carriage and wagon departments. The company already possesses several laboratories in which scientific research work is undertaken. These establishments are to be extended, and through them Sir Harold will carry out part of his duties. He is also to be responsible for continuing the "rationalisation" process in connection with the company's workshops. Sir Harold since 1901 has been a Fellow and Tutor of Balliol College, Oxford, and is Bedford Lecturer on Physical Chemistry. During the war he was Controller of the Chemical Warfare Department, and in 1919 served as head of the mission which was appointed to report on the German chemical factories. He has served on several Government Committees dealing with the application of scientific research to industry and is a member of the Fuel Research Board. Since 1922 he has been a director of the Gas Light and Coke Company.

Improved Railway Goods Depots.

THE announcement is made that the London, Midland and Scottish Railway Company will shortly begin work on several of the schemes for the improvement of goods terminal accommodation, which are included in the expenditure of close upon £450,000 provided by the remission of the Government passenger duty. The schemes now in hand provide for new shed and siding accommodation at the Ettingshall Station between Birmingham and Wolverhampton, and the provision of additional storage accommodation for metal at the Birmingham Central depôt. Other centres at which the goods yards will be remodelled and increased siding and warehouse space, with modern lifting facilities be provided, are the Great Bridge Station between Dudley and Walsall and Stoke-on-Trent, where special attention will be given to the coal traffic requirements. The warehouse accommodation at the Birmingham (Curzon-street) Station is to be enlarged, and provision for additional timber storage is to be made at Speke Junction in Lancashire. At Goole Docks a new goods depot is to be built with siding and craneage facilities, while the Camden goods station in London is to be extended and improved.

A New Danish Motor Ship.

THE motor ship "Amerika," which was recently built and engined by Burmeister and Wain, of Copenhagen, for the new Californian service of the East Asiatic Company, is noteworthy as being the largest motor vessel built in Denmark and the first to be equipped with the new B. and W. two-stroke, double-acting oil engine. She has a length between perpendiculars of 465ft., with a beam of 62ft., and a depth of 40ft. Her deadweight carrying capacity on a 29ft. loaded draught is 11,375 tons, with a measurement of about 10,100 gross tons. She is propelled by a single screw, driven by six-cylinder, two-stroke, double-acting oil engine, with 620 mm. by 1400 mm. cylinders. At 95 to 100 r.p.m. the rated output of the engine is 6000 S.H.P., with a mean indicated pressure of 92 lb. per square inch, and on her shop trials the engine developed 9000 I.H.P., or about 8000 B.H.P. During the sea trials an output of 6450 B.H.P. was maintained, and the fuel consumption for all purposes worked out at 0·365 lb. per S.H.P. hour, corresponding to about 24 tons of oil per day. The trial speed of the ship was about 16½ knots, but in service the "Amerika" will run at about 14½ knots. The propelling and auxiliary machinery are of especial interest, as in addition to the new two-stroke, double-acting engine with exhaust piston valves and port scavenging, there are three 600 B.H.P. two-stroke, single-acting auxiliary engines of a new B. and W. design, and four motor-driven rotary B. and W. type scavenge pumps. The general lay-out of the machinery embodies several special features, and both the builders and the owners are to be congratulated on the highly economical and smooth running of the engines, which was recently demonstrated in the speed and manœuvring tests carried out in Copenhagen Sound.

The English Electric Company.

THE English Electric Company was formed at the end of 1918 as a combination of Dick, Kerr and Co., and the United Electric Car Company, of Preston, the Coventry Ordnance Works, the Phœnix Works at Bradford, and the Siemens Works at Stafford. It controls Willans and Robinson, of Rugby, the Siemens and English Electric Lamp Company, and the English Electric Company of Canada. Its authorised capital is £5,000,000. The company's balance sheet for 1927 disclosed serious losses, and it was apparent that, if the business was to survive, drastic reforms were necessary, not excluding financial reorganisation at the appropriate moment. Measures then adopted enabled overhead expenses to be cut down and the technical and operative efficiency of the undertaking to be improved. Lack of the necessary capital, however, has prevented the completion of the improvements, and the economies effected have not by themselves been sufficient to meet the whole of the debenture interest. In a letter issued to the debenture and shareholders, the chairman, Mr. W. L. Hichens, has this week given details of a scheme for the financial reorganisation of the company, prepared in co-operation with Lazard Brothers and Co., whereby it is hoped that profits and business will be increased, fresh working capital will be provided, and public confidence in the ability of the company to fulfil its contracts will be re-established. The financial details of the scheme are too involved to be reproduced here in full. They include the writing down of preference shares from £1 to 12s. 6d., the cancellation of all preference share dividends accrued and unpaid to December 31st, 1929, and the writing down of the ordinary shares from £1 to 3s. 4d. The reduction of capital effected by these steps will amount to a total of £1,755,528. The board of directors is to be reconstructed, but the control of the company is to remain in British hands. The fresh capital, amounting to £750,000, is to be contributed by Lazard Brothers, and will be applied to the liquidation of all bank overdrafts and to re-equipment purposes.

The Cancelled Cruisers.

IN last week's issue we referred to the decision of the Government definitely to cancel the construction of the two 10,000-ton cruisers "Surrey" and "Northumberland," work on which was suspended in July of last year. These two vessels belonged to the 1928–29 programme. It appears that, in addition, the Government almost simultaneously decided to cancel the construction of two cruisers in the 1929–30 programme. One of these vessels was to have been a 10,000-ton ship carrying 8in. guns, and the other a smaller ship mounting 6in. guns. It therefore follows that altogether Mr. MacDonald's Government since its accession to power has stopped the intended construction of four cruisers, having a total displacement of more than 36,000 tons. From the 1929–30 programme it has also deleted the building of four destroyers, one net layer and target-towing ship, two sloops, and three submarines. These cancellations are apparently additional to those of the submarine depôt ship and the two submarines to which we referred last week. It is officially estimated that the dropping of the construction of these twelve vessels from the 1929–30 programme will represent a saving of about £6,500,000. The cancellation of five submarines from the two programmes has attracted considerable comment, for we are already relatively weak in this class of vessel. We occupy as regards submarines, built or being built, the fourth position in the world's navies. The United States is at the head with 127, France is second with 99, Japan third with 71, this country with 63 is fourth, and Italy is fifth with 57. Many questions on the cancellation of these vessels were addressed to the Government in the House of Commons on Wednesday of this week. The decision not to proceed with them had, it was stated, been taken in the light of the country's naval needs and of the economic use of public money. It was also announced that the ships remaining in the 1929-30 programme, namely, one cruiser, four sloops, four destroyers and one flotilla leader, would be built at Devonport, Portsmouth and Chatham dockyards, except for the flotilla leader and two of the destroyers, which would be built by contract.

The New Lambeth Bridge.

ON Thursday of last week, January 30th, the steel caisson for the No. 1 pier on the Westminster side of the new Lambeth Bridge was safely lowered into position. It is of rectangular shape, with a length of 108ft., a width of 37ft., and a depth of 15ft. The weight of the structure is close upon 450 tons, and it was lowered by allowing water to escape slowly from four hydraulic rams fitted with the usual check-nut devices. Work is already in progress on the No. 4 pier on the Lambeth side of the bridge, and the temporary caisson has been attached to the permanent caisson, and excavation and filling under compressed air are now taking place. Arrangements are being made for lowering the caissons for the No. 2 and No. 3 piers, and preliminary operations before the building of the abutments are now being carried out. The new bridge will consist of five spans:—a centre span of 165ft., two intermediate spans of 149ft., and two approach spans of 125ft. 4in. A roadway, 36ft. in width, with two 12ft. footways, is provided, giving a total width of 60ft. The caissons, which are to be filled with concrete, will be sunk to a solid foundation about 25ft. below the river bed. It is estimated that about 3500 tons of steel will be employed in the construction of the new bridge. The contractors are Dorman, Long and Co., Ltd., of Middlesbrough and London, and the engineer is Sir George Humphreys, K.B.E., the Chief Engineer to the London County Council, whose retirement in next November has been announced. In the design of the new Lambeth Bridge Sir George has been associated with Sir Reginald Blomfield, R.A., and Mr. G. Topham Forrest, F.R.I.B.A., the Chief Architect to the London County Council. The work of demolishing the old suspension bridge, built by Mr. P. W. Barlow in 1863, was begun by Dorman, Long and Co., Ltd., about a year ago, and it is expected that the new bridge will be completed some time in 1932.

Proposed New Howrah Bridge, Calcutta.

STILL another Report has been made regarding the construction of a bridge across the River Hooghly between Calcutta and Howrah. It was presented to the Commissioners for the Port of Calcutta towards the end of last year by Messrs. Rendel, Palmer, and Tritton, of Westminster. The Report, of which a copy lies before us, is divided into two sections, each dealing with an alternative design, the first being concerned with a bridge of the cantilever type, while the other discusses a floating non-opening bridge. In each case a preliminary estimate of cost is given.

CANTILEVER BRIDGE.

In dealing with the cantilever bridge—which, it is proposed, should have a main span 1500ft. long between centres of towers, and two anchor spans each 446ft. long—it is pointed out that the question of building a bridge in the position proposed has been very considerably modified by two important factors :

(*a*) That it has now been decided that it is unnecessary for ocean-going steamers to proceed above the bridge ; and

(*b*) The discovery of the existence of a bed of hard clay 97ft. below the surface on the Calcutta side and 79ft. below the surface on the Howrah side.

"The first of these factors, eliminating the necessity for an opening span, greatly simplifies," continues the Report, "the design for a single-span bridge, while the second entirely revolutionises the previously held opinions as to the permissible foundation loads in the neighbourhood of Calcutta. Until this stratum of hard clay was discovered, we were of opinion that the difficulties in regard to a single-span bridge were almost insuperable, because of the enormous loads which would have to be carried by the abutment foundations—loads far in excess of anything previously attempted in this locality."

It appears that tests carried out in 1921 by the Chief Engineer of the Port Commissioners, to ascertain the bearing capacity of this clay bed, showed that, with a load of 5½ tons per square foot, the settlement was almost negligible. Confirmatory tests carried out by Messrs. Rendel, Palmer and Tritton with cylinders sunk 10ft. into the hard clay proved that with a load equivalent to 12·1 tons per square foot there was practically no sinking on the Howrah side, while on the Calcutta side a load of 16 tons per square foot was supported without sinking, skin friction being eliminated in each case. The load proposed for the Howrah abutment foundation of the bridge would amount to an average of 6·14 tons per square foot, with a maximum toe pressure of 6·5 tons per square foot. On the Calcutta side the average load imposed on the abutment would only be 7·3 tons per square foot, with a maximum toe pressure of 7·8 tons per square foot. "These tests," adds the Report, "show that on both sides of the river the clay bed will have a factor of safety of almost exactly 2 under the worst conditions of load and of wind pressure—a combination which can never come about in actual practice, as, in a wind of the velocity required to give the maximum wind pressure, there can be little (if any) live load crossing the bridge."

It is then explained that the weight at present carried by the clay bed at the level down to which it is proposed to take the foundations—which load consists of the soil above that level—amounts to about 4·3 tons per square foot on the Howrah side and about 5·6 tons on the Calcutta side. The whole weight of concrete and masonry up to the bearing plates for the proposed superstructure, only amounts to about 3·94 tons per square foot on the Howrah side and to 5·10 tons on the Calcutta side, or about one-third of a ton per square foot on the Howrah side and half a ton on the Calcutta side less than the clay bed already bears. The proposed superstructure would impose a load of about 2·2 tons per square foot on each side. That would, as already stated, bring the foundation load per square foot up to 6·14 tons on the Howrah side and 7·3 tons on the Calcutta side, so that the total load to be carried by the clay bed would only amount to about 1·8 tons per square foot in excess of its present natural load. "The margin of safety of about 2 to 1 does not take into account the "skin friction" of the monoliths themselves, which will, however, materially add to that margin.

The Report then proceeds to describe how it is suggested that abutment foundations should be formed. It is proposed to enclose the whole area with steel sheet piling driven from above the highest high water level down into the clay, so as to avoid such "blows" and inrushes of water as gave so much trouble in sinking the test cylinders. The monoliths or wells which would be sunk to form the foundation would, in the aggregate, cover an area of 116ft. by 196ft., or 22,736 square feet for each abutment. The number of monoliths on each side would be fifteen, each 36ft. square, spaced 4ft. apart. It is evidently the intention to arrange the monoliths as shown in the accompanying sketch—Fig. 3—the twelve monoliths sunk being shown unhatched. Since it is explained that the estimates provide for sinking only twelve of the total number, as it is intended "to excavate, in the dry, the area enclosed by the twelve monoliths, and thus save the cost of well sinking." In the design of the foundations, special attention was given to keeping down the load to the minimum possible. The monoliths would be built of reinforced concrete, so as to reduce the thickness of the walls, and would form what would be practically a cellular construction with a bed of concrete

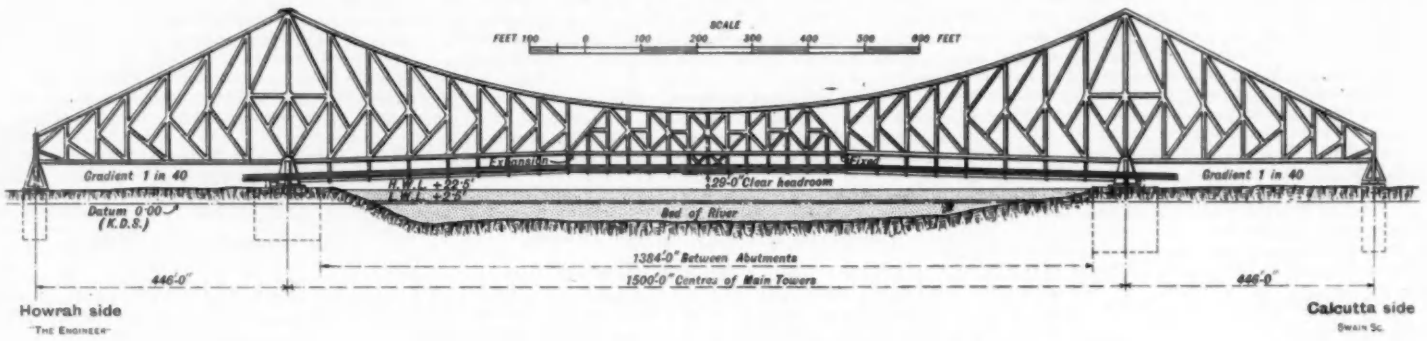


FIG. 1—SIDE ELEVATION OF PROPOSED CANTILEVER BRIDGE

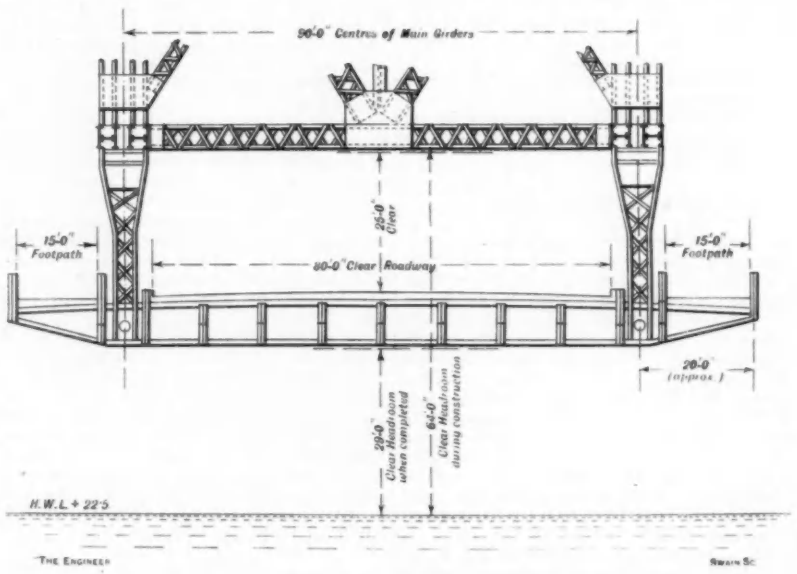


FIG. 2—CROSS SECTION OF PROPOSED CANTILEVER BRIDGE

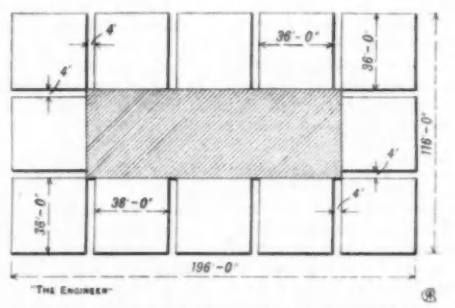


FIG. 3—ARRANGEMENT OF MONOLITHS IN ABUTMENT FOUNDATION

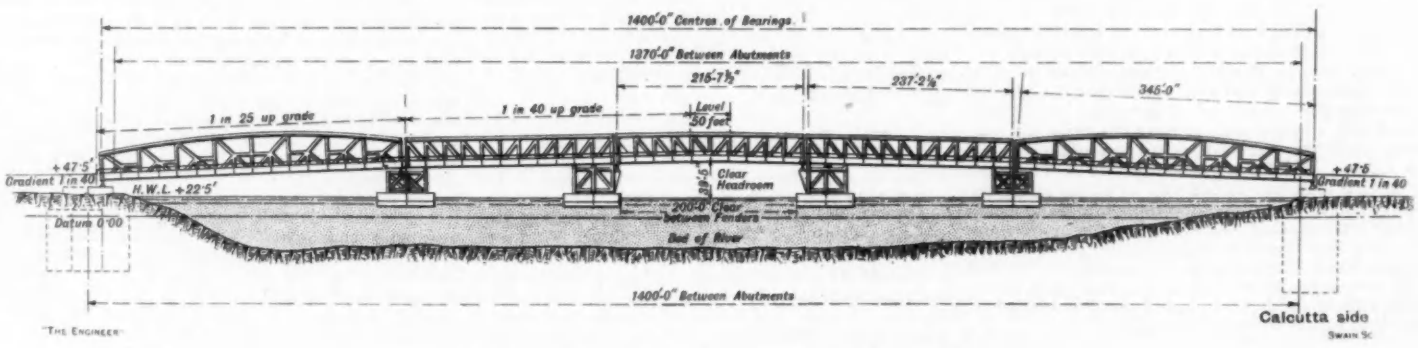


FIG. 4—SIDE ELEVATION OF PROPOSED FLOATING BRIDGE

at the bottom to spread the load of monoliths and superstructure over the whole area excavated.

The foundations for the anchor arms of the cantilever would be constructed in the same manner and, approximately, to the same depths, so as to provide practically the same unit loads on the clay as in the abutments. This, the Report points out, is necessary for construction purposes, but when the bridge is completed, the weight of the superstructure between the main abutments will more than counterbalance the weight of the anchor arms and the excess will be taken by the weight of these anchor foundations, with an ample margin of safety.

The form of superstructure proposed is shown in Fig. 1, while a cross section through the centre of the suspended span is given in Fig. 2. It was originally proposed that tramways should be taken across the bridge, but the idea was given up, and it is now suggested that there should be a clear roadway, 80ft. wide, and a footway, 15ft. wide, outside each main girder, these footways being carried on extensions of the cross girders. The overall width of the bridge would be about 130ft. It is suggested that the two arms of the main span should be built outwards until they met in the centre, when they would be joined up, the central portion being thus changed from the cantilever form to a suspended span. This construction has the advantage of entirely obviating the risk attaching to building the suspended span girders separately, and then floating out such heavy loads and lifting them into position. The floor system would be carried on hangers and a clear headway of 25ft. given for vehicular traffic. The lower chord of the bridge, as designed, would be at a height of 64ft. above the highest water level in the fairway of the river, so that, in the extremely unlikely event—as it is described in the Report—of an ocean-going vessel colliding with the bridge, only the masts and possibly the funnels of vessels could reach the main structure, which is further protected on each side by the projections—about 20ft. wide—carrying the footways. Any damage to the floor system would be quite local and easily repaired, and it would not affect the stability of the main structure. The carrying of the bridge floor on hangers from the main girders would have the additional advantages, first that those girders could be completely erected before the weight of the floor system was added, and, secondly, that during the erection of the main structure there would be the clear headway already mentioned of 64ft. for navigation.

The Report also enters into the questions of the loading for which the bridge has been designed, and of the approaches to the structure, but at the present moment we need not discuss these matters.

The preliminary estimated cost of the entire structure is given as follows :—

	£
Foundations	620,896
Foundation plant charges, including supply of electric current	89,102
Superstructure	1,477,790
Superstructure plant charges, including supply of electric current	227,666
	£2,415,454
Overhead charges and contingencies, 10 per cent.	241,545
	£2,656,999

which sum, given in rupees, represents an expenditure of 3,54,26,659.

FLOATING NON-OPENING BRIDGE.

The second portion of the Report explains how that, originally, designs were got out for a floating bridge with an opening span giving a clear waterway of 200ft. While the design of that bridge was being finished, the Port Commissioners approached the Inland Steamer Companies to ascertain what headroom would be required if a floating bridge could be made without an opening span. At first it was stated that not more than 35ft. would be required, and it was decided to do without an opening span. That altered the whole of the conditions and made it possible considerably to decrease the cost of the bridge. The figure 35ft. was subsequently altered to 38ft., in order that one particular vessel, a bucket dredger, might be able to pass the bridge. Messrs. Rendel, Palmer and Tritton looked into the question and found that a headroom of 37ft. for a loaded span and of 39·5ft. for an unloaded span could be obtained by allowing for a gradient of 1 in 40 towards both ends of the centre span. The general design proposed for a bridge of this type is shown in Fig. 4. In the unloaded condition, with high water level in the River at 22·5ft. above datum, the end spans would have an up-gradient of 1 in 25. The intermediate spans and part of the centre span would have a continuous up-gradient of 1 in 40, while the middle 50ft. of the centre span would be level. The headroom under the centre span would be 39ft. 6in. over a width of 50ft. with a clear width of 200ft. between fenders. In the fully loaded condition, with a low water level in the River of 2·5ft. above datum, the end spans would have a down gradient of 1 in 39, the gradients of the other spans remaining the same as in the unloaded condition, while the headroom would be reduced to 37ft.

The proposed bridge would comprise five spans carried on two abutments and four floating pontoons. The two end spans would have each a length of 345ft., the two intermediate spans each a length of 237ft. 2½in., while the centre span would have a length of 215ft. 7½in. The length of the bridge between abutments would be 1370ft., and between centres of bearings 1400ft.

A cross section of the centre span is given in Fig. 5. It will be seen that a roadway, 80ft. wide, and two 15ft. footways are provided for, as in the proposed cantilever bridge. It will be observed, too, that the cross girders carrying the roadway, &c., are erected on lattice trusses, the approximate overall length of which is 344ft., and which are supported on a series of pontoons. The floor system would consist of steel trough flooring, containing concrete to a height of 3in. above the top of the steel troughing, the steel troughing being first lined with asphalt ¾in. thick to protect it from corrosion. The road surface would be composed of Mexphalt, 1¼in. thick, mixed with grit.

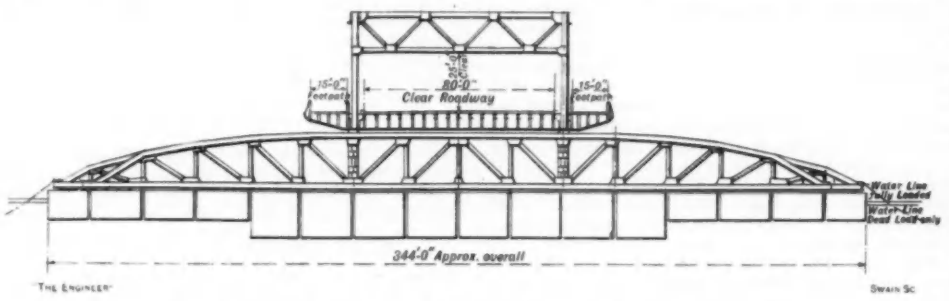


FIG. 5—CROSS SECTION OF CENTRE SPAN OF FLOATING BRIDGE

The preliminary estimate of the cost of a bridge of this type is as follows :—

	£
Foundations	245,000
Foundation plant charges	74,000
Superstructure, including pontoons, supporting girders and moorings	936,010
Superstructure plant charges	138,380
	£1,393,390
Overhead charges and contingencies, 10 per cent.	139,339
Total	£1,532,729

or, in rupees, 2,04,36,385. The cantilever bridge would therefore cost some one and three-quarter times as much as a floating bridge.

The question of how best to erect the floating bridge was gone into very carefully, and the plan proposed would, it is estimated, cost about 15 per cent. of the total cost of the bridge. At first, it was thought that it would be best to erect the spans parallel with the river and slew them round into position on pontoons. It was eventually decided, however, that a much better plan would be to build them in line with the bridge and push them forward on a temporary track, and the estimate was based on the assumption that that method would be adopted. For that purpose there had to be included the cost of temporary concrete walls on the Howrah side, supported on screw piles taken down into the clay and parallel with the axis of the bridge. Part, and perhaps the whole, of these walls would, however, be available for the approach roads.

The estimates in the case of both bridges include charges for insurance, freight, import duty, and landing dues for all steelwork plant, &c., which may be shipped from home, while, in the charges for plant, allowances were made for the amounts recoverable by the sale of such portion of it as might be disposable at the termination of the work of erection.

IT is proposed to place facilities at the disposal of the leading industries and commercial firms of recognised standing to enable them to make, under expert guidance, sound films which can either form part of the regular equipment of both their sales representatives and their expert technicians, or can be used for demonstration purposes in shops and at exhibitions and trade fairs. Such films can be made at a comparatively low cost in almost any language desired and any number of versions can be prepared.

Scientific and Industrial Research.

THE fourteenth annual report of the Advisory Council for Scientific and Industrial Research, covering the year 1928–29, was published by H.M. Stationery Office at the beginning of this week. Below we give a summary of those portions of the Council's reports which have a particular bearing on engineering science and technology.

All the research organisations of the Department have the same tale to tell of increased requests for special investigations and for advice on industrial problems, and of the cordial co-operation and help they have received from outside.

Nowhere is the increase of industrial co-operation more marked than in connection with building research. Welcome contributions have been received from the National Federation of Building Trades' Employers towards the general work of the Building Research Station. The Institute of Builders contributes to the cost of the publication of *Building Science Abstracts*, and has recently set aside a sum of money to provide studentships of £50 to £150 a year tenable for two years at the Building Research Station in order to encourage the spread of higher scientific education throughout the industry. The British Steelwork Association has offered to meet half the cost—up to £2000 a year for five years—of a general investigation of problems bearing on the use of steel in structures. This is an inquiry to which the Council attaches considerable importance. The standard "safety" regulations governing the design of steel structures in this country are now some fifty years old, since when there has been a marked advance, not only in the quality of steel, but also in our knowledge of the theory of structures, which has been brought about largely by the development of aircraft. The investigations will follow naturally on those made by the Bridge Stress Committee.

There have been two other similar developments during the course of the year which are worthy of special mention. The first is the formation of a Committee to examine the suggestion that a national locomotive experimental station should be established under the auspices of the Department. Towards the end of 1927 it was urged by representatives of the British railway companies that the establishment of such a station would be of national advantage. Inquiries showed that all the railway companies and private locomotive manufacturers were in sympathy with the objects of the scheme. The Committee of Inquiry, of which Sir Alfred Ewing is Chairman, has already held five meetings, and is expected to report this year. It is of interest to note that schemes for the construction of similar plant are under consideration in France and Germany.

The second important development is the formation by the National Federation of Iron and Steel Manufacturers of an Industrial Research Council to organise investigations of problems bearing on economic production. Such investigations will include the examination of blast and steel furnace practice, rolling mill practice, and allied problems. It is not proposed to carry out independent metallurgical investigations of the type now being undertaken by many industrial and national research laboratories, but to collaborate fully with these laboratories so as to assist in the application to industrial practice of the results of scientific research. It is hoped that the new research organisation will also provide an intelligence centre for the exchange of information on all new developments both at home and abroad which have a bearing on the production of iron and steel. For the next five years the Department is to make a £ for £ grant in respect of all subscription income received from the industry over and above a minimum of £2000 a year, with a limit of grant of £10,000 a year.

FUEL RESEARCH.

During the year the low-temperature carbonisation plant at Richmond which has been erected by the Gas Light and Coke Company to designs developed at the Fuel Research Station, has been started up, and is now operating satisfactorily with only the minor difficulties inevitably associated with a new operation of this kind. The plant is designed to deal with 100 tons of coal a day, and the limited quantity of semi-coke produced has found a ready sale under the name of "Gloco." It is only by continuous working over a long period that it will be possible to form a final conclusion as to the commercial possibilities of this plant, but the experiment on a large scale has already demonstrated its technical merits. In the meantime, work has been continued at the Fuel Research Station on the single retorts, with the object, in the first place, of developing a form of retort which will have as long a life as possible, and in the second place of determining the most appropriate types of coals and blends of coals for carbonisation at low temperatures. It is interesting to note that the experimental retorts which were constructed to the design of the British Cast Iron Research Association and made of special material recommended by that Association, have shown no sign of distortion after fourteen months' continuous operation. This is a most satisfactory result since the commercial success of this plant will

probably rest very largely on the life of the retorts. No other retort yet tested at the station has had so long a life without measurable and even serious distortion.

Various low-temperature research plants besides that at Richmond are now working under conditions and on a scale that should enable definite conclusions to be drawn within a few years as to the extent of their commercial success and the probable scale on which they can be profitably worked. Extravagant optimism based on insufficient data seems at last to have been almost entirely replaced by a keen desire to ascertain the facts by properly controlled industrial experiments.

Concurrently with these developments there has been a marked increase in recent years of experiments by the gas industry on the carbonisation of coal at all temperatures. It was, therefore, thought wise during the year to ask the Fuel Research Board to review the whole programme of research, which has been devoted so much hitherto to problems of carbonisation. The Board now advises that the time has come when priority shall no longer be given to the problems of carbonisation which are of special interest to the gas industry, although it considers that the programme on horizontal retorts should be completed without any attempt to limit its scope. It is proposed that the work should now be developed in other directions. One of these is a general investigation of furnace design with particular reference to the burning of pulverised fuel. The chief technical problem is to secure complete combustion in a small space. The successful use of pulverised fuel has been dependent, up to the present, upon the provision of excessively large combustion spaces, for which there does not seem to be any basic necessity. This is a serious handicap when it is desired to apply the system to ships, where conservation of space is of so much importance. Preliminary experiments appear to indicate that combustion space can be very largely cut down without practical disadvantages, and intensive work will be undertaken in this direction. The main problem to be solved is how to make a small particle of coal burn as quickly as possible. The complete examination of this problem will involve physical research of great interest and possibly of great difficulty.

The Board is also exploring in detail the possibility of making extensive investigations on the production of metallurgical coke. This is a problem of carbonisation which has not been studied with anything like the care and detail it deserves. At present metallurgical coke is only obtainable from certain types of coal, and although plentiful supplies of such coal occur in some of the British coalfields, it is of primary importance to the coal industry to extend the area of supply as much as possible. There are indications that satisfactory coke can be made from coals and blends of coals which are at present considered unsuitable, but systematic investigation will be necessary to secure this result. Accurate information is also needed on the type of coke oven and of treatment which will secure the best results from the coals now used.

It is also proposed to complete a detailed investigation into the manufacture of water gas, which is of importance not only to the gas industry, but to many branches of the chemical and other industries.

An investigation was started some years ago into the Bergius process for the hydrogenation of coal. This process consists in treating the coal with hydrogen at high temperatures and pressures, and the result is, when using suitable coals, to convert some 60 per cent. or more of the coal substance into distillable oil. The technical possibility of the process has been proved, and its commercial possibilities and those of its modifications are being explored by industry.

A plant designed for continuous working and capable of treating 1 ton of coal a day is in operation at the Fuel Research Station, and is being used for investigating the reactions that take place, and the conditions necessary to promote them. The process is now being studied, using coal with the lowest content of inorganic matter that can be obtained or prepared, and this will be followed by the addition of inorganic substances so as to ascertain what effect, if any, is produced by the various inorganic substances contained in the "ash" of coals. The investigation promises to throw much light on the constitution of the coal substance, and the manner in which it is broken down by various methods of treatment. The apparatus is also in use for the treatment of tars produced by low-temperature carbonisation.

Forest Products Research.

The successful introduction of new timbers is not an easy task. The coniferous timbers from the temperate regions of the Empire are already extensively exploited, and the main problem is to explore the possible uses of hardwoods from the tropical and semi-tropical regions. Preliminary tests on small samples of timber can give some indication of its possible uses, but it is far too risky under present conditions to encourage the marketing of new timbers on a large scale without previous elaborate tests of seasoning, woodworking, and mechanical properties, as well as of other properties for special purposes. As any particular timber varies in its properties from tree to tree, and according to time of growth and felling, such tests have to be carried out on large quantities of timber so as to get a good statistical average of results. The whole series of tests is not only long but expensive, and it is of great importance that they should only be carried out when there is a reasonable chance, if the results of the tests warrant it, of the timber being marketed in satisfactory quantity and quality, and at a price which will enable it to compete commercially with other known timbers of similar quality. Many of the natural hardwood forests of the Empire, however promising they may appear from a casual inspection, are either inaccessible or show such a mixture of species that their commercial exploitation is out of the question at present; but there are undoubtedly many other forests which are perfectly capable of commercial exploitation if a use can be found for their timbers. It was with these considerations in mind that the Council advised the formation of an Empire Timbers Committee of the Forest Products Research Board, charged with the duties of selecting Empire timbers for investigation, of determining their order of priority, and of giving advice on references concerning general policy arising out of the scheme.

Pending the completion of extensions to the buildings and plant at Princes Risborough, it is proposed to make a start by arranging for the necessary expansion of the staff, by beginning such investigations of new Empire timbers as are possible with available facilities, and by making inquiries and giving assistance in the problems of utilisation.

Radio Research.

The progress made in the general science of radio communication since the formation of the Radio Research Board has been remarkable. For example, the greatest accuracy with which the frequency of a wireless wave could be determined ten years ago was less than one part in 5000. To-day, an accuracy of one part in 100,000 can be obtained, the determination being based on the astronomical second. With so many radio communications being carried out simultaneously, interference can only be avoided by each station keeping strictly to its allotted frequency, so that the importance of accurate standards of measurement of frequency is obvious. Very considerable advances have also been made in the measurement at high frequency of electrical quantities such as current, resistance, capacity, &c.

Ten years ago the theory of the propagation of waves was very imperfectly understood. Certain empirical formulæ which were recognised as inadequate, held the field, and although the hypotheses of Heaviside and Kennelly indicated that the ionisation of the upper regions of the atmosphere probably played a considerable part in wave propagation, yet their suggestions were only partially accepted, often under protest, in lieu of anything better. As a result of the work carried out for the Board, the first positive and direct experimental proof was obtained of the existence of the ionised layer, and methods were developed for studying in detail its effects on radio waves. The continuation of this work, together with an intensive study of the effect of the ground in attenuating that portion of the energy from a transmitting station which travels over it, is daily yielding data which are going far to place the theory of the propagation of waves upon a completely satisfactory basis. These methods have already offered adequate explanation of many previous inexplicable phenomena such as "fading."

When the Board was formed it was found that widely different opinions were held as to the reliability of radio direction-finding. Some held that direction finding was a satisfactory aid to marine navigation; others believed that the variable errors encountered rendered it unsafe to place reliance on the bearings obtained. During the past ten years careful investigation of the causes of the errors to which direction finding sets may be liable has completely reconciled these conflicting views. The conditions under which bearings obtained by wireless methods may be regarded as reliable have been clearly formulated. Adequate explanations of the causes of the variable errors have been obtained, and the results of this fundamental work have been used in developing improved methods for direction finding practically free from such errors.

Ten years ago the nature and source of atmospherics were also imperfectly understood, and serious hopes were entertained by scientific men as well as by most amateur inventors of being able to eliminate atmospherics for the purpose of reception. Over a hundred patent specifications covering such methods had been taken out. All the methods proved to be failures to a greater or less degree. The cause of this wasted effort was mainly due to the fact that those striving to eliminate atmospherics resembled detectives hunting for a criminal without any information as to his appearance, habits, or habitat. The work of the Board has gone far to provide the data that were lacking. The wave form of atmospherics and their main sources have been determined. Methods have been devised for finding their mean direction of arrival and even the place of origin of individual atmospherics. Although the work has shown that means for their complete elimination will probably never be realised, nevertheless methods have been developed for utilising to the full the directive properties of aerials and the general selectivity of receivers for their mitigation in any locality. There are indications also that this branch of the Board's work may have valuable applications in the sphere of meteorology and aerial navigation.

Water Pollution Research.

The Council has considered and approved plans of the Water Pollution Research Board for a biological and chemical survey of the river Tees.

The object of this investigation is to ascertain by careful observation and experiments, the effect of different types of effluents on the fauna and flora of a river, and particularly to explore the extent to which self-purification takes place. The Board was of opinion that many of the current ideas of the evil effects of different effluents are founded on wholly insufficient evidence, and that little progress would be made towards the purification of rivers in industrial districts until more scientific knowledge had been accumulated. The river Tees has been selected for investigation as many different types of effluents are discharged into it, both in tidal and non-tidal reaches. The results of the study should be applicable in general to other rivers.

The experiments which were commenced in 1927 on the purification of the waste waters from beet sugar factories by the process of biological oxidation on percolating filters, were continued during the 1928–29 sugar beet campaign. The investigation has included experiments in the laboratory and on a semi-commercial scale. During the 1927–28 campaign, under the conditions employed, a purification of 70 to 80 per cent. was obtained, and this was improved to 90 per cent. purification in the semi-commercial scale experiments carried out in the following year. In view of the promising results which have been obtained, the Council has approved the recommendations of the Board that the investigation should be continued during the 1929–1930 campaign with the object of ascertaining what further improvement in the process can be made.

Gas Cylinders.

During the year the Gas Cylinders Research Committee presented its final report and has now been dissolved. A detailed account of its work has been already published in various reports.

William Froude National Tank.

During the year the Council received a report from the Executive Committee of the National Physical Laboratory pointing out the desirability of providing an addition to the Froude Tank at the Laboratory. This Tank was constructed in 1909–10, through the generosity of Sir Alfred Yarrow. Its purpose is two-fold—(1) to carry out research of a general character for the increase of knowledge concerning ship resistance and propulsion and other problems relating to the motion of ships, and (2) to make tests on ship forms, propellers, &c., for shipping firms and other bodies, for which payment is received. In early years the number of tests carried out for firms for repayment was not very large, and adequate time remained for research work of the type referred to above. In recent years the number of tests and investigations asked for has greatly increased, so much so that although the hours of work at the Tank have been increased up to the limit practicable, it is impossible to cope with all the demands, and the time that can be given to research has been reduced almost to vanishing point. This state of affairs is regarded by the Council as satisfactory in that it shows the great interest taken in the work carried out in the Tank and the practical value that is attached to the results of the tests and investigations, but unsatisfactory when it is remembered that this practical value is largely the result of research in the past. Unless research can be maintained continuously on a reasonable scale, the direct value of the work of the Tank Department to industry will be bound to diminish as time goes on. The Executive Committee was anxious, therefore, to secure some means of extending the facilities available which would enable it to put research work on a better basis. In view of the fact that although all special tests and investigations are paid for by the firms requiring them, such payments do not include any overhead charge corresponding to the capital cost of the equipment. The Council considered that it could hardly justify a recommendation that the Department should bear the whole cost of an additional Tank. But, recognising the strength of the case and the importance of giving the same kind of assistance and encouragement to the shipping industry as the Department has given to other industries, it has recommended that the Department should offer to bear half the cost of the addition, up to a maximum charge on the Department's funds of £10,000.

Researches on Electro-deposition.

In view of the special importance to the Service Departments of processes of electro-deposition, a Departmental Research Committee was appointed in 1926 to make arrangements for comprehensive researches bearing on industrial problems of electro-deposition of special interest to Government Departments. The chief items of the Committee's work have been—(1) the investigation of pitting and

porosity in deposits of nickel, iron and other metals; (2) the protection of aluminium against corrosion by the electro-deposition of zinc and cadmium; (3) an investigation into the fundamental aspects of the nature of adhesion and of internal stresses in electro-deposits.

Work on the first item has been concentrated at the Research Department, Woolwich. It has been shown that "pitting," which greatly diminishes the protective value of thin deposits of nickel, and affects deleteriously the mechanical strength of thicker deposits, such as are needed for building up worn or undersized parts of machinery, can be largely prevented (1) by the preliminary coating of the metal with a thickness of not less than 0·0003in. of electro-deposited copper before the final deposition of nickel is made, and (2) by the careful control of the acidity of the solution within quite narrow limits. A number of other contributory causes have been studied, and there is little doubt that further practical progress can be made by a more detailed investigation of the conditions of deposition. At the Royal Aircraft Establishment, Farnborough, considerable progress has been made into investigations on the deposition of zinc on aluminium. Successful experiments have been made on a small technical scale with zinc sulphate and zinc cyanide baths; and test pieces of aluminium, protected by zinc in this manner, have been subjected to severe corrosion tests, with satisfactory results. All this work has naturally involved an immense amount of detailed investigation on the effect of current density, concentration and acidity of solutions, and of the addition to the solutions of colloids such as gum arabic.

At Sheffield University the internal stress in electrolytic deposits of nickel has been exhaustively studied. The existence of internal stress is liable to cause peeling of deposits from the basis metal, and the main object of the researches has been to find means of avoiding the production of stress during deposition It has been shown that under suitable conditions the use of alternating current, in addition to the direct depositing current, leads to the formation of deposits practically devoid of internal stress.

Unfortunately, the electro-plating industry is not organised in such a way as to facilitate co-operation in scientific research of this character. Some large engineering firms, which use methods of electro-deposition, carry out investigations of their own, but the firms which specialise on methods of electro-deposition are nearly all in a small way of business, and are still working practically by rule-of-thumb methods. For the present, it is felt that the prospect is small of scientific work of this kind being developed more energetically by the electro-plating industry, and since the direct importance to the Service Departments of an improvement in methods is undoubtedly great, the Council recommends that the Committee should continue its work for a further three years, with an allocation of £2000 a year.

Scientific Grants.

The grants to the Royal Institution for the assistance of Sir William Bragg's work on X-rays; to the Imperial College of Science in aid of Professor Bone's work on high-pressure reactions; and to the Cavendish Laboratory, Cambridge, in aid of Dr. Kapitza's magnetic researches, have been continued.

Dr. Kapitza's important investigations on the properties of the elements in strong magnetic fields at the temperature of liquid air have reached the point where experiments at still lower temperatures are desirable. The University Committee which administers this grant advised the Council that a plant for the provision of liquid hydrogen could be erected at a total cost of £1500. In view of the outstanding character of the work, and also of the circumstance that, so far as the Council knows, no apparatus for the production of liquid hydrogen exists in this country, the Council recommended that the Department should make this further grant. If the scheme is successful, it may be desirable to extend it still further later on by the addition of plant for the production of liquid helium.

Seven Senior Research Awards were made during the year 1928–29 on the Council's recommendation. These awards, which are limited in number, are made to students who have shown exceptional capacity for original work, and are tenable for three years. The number of applicants with any serious claims on these awards has been somewhat small, and at first sight disappointingly so. It is probable, however, that investigators showing the high capacity for research required for senior awards have already had their ability otherwise recognised, as by absorption into the staff of universities or research institutes.

There is some evidence that the object of these awards, which have been in existence only one year, is not yet fully understood. They are intended to help young research workers who have shown such capacity for original work that they are likely to become real pioneers in their special fields of study. The Council would welcome the co-operation of Professors in bringing before it candidates who are deserving of special encouragement from this point of view, so that they may have the opportunity, which the awards are intended to provide, of developing their special bent.

The Council has observed for some time that it gets very few applications for maintenance grants from students desiring to take up research on some engineering subject before going into industry. The Council thought it worth while to make some inquiries as to the cause of this, and a conference of professors of engineering was held in the Department in February, 1929. The general opinion was that a student was deterred from doing research by three main considerations:—(1) The importance of obtaining works experience as soon as possible after completing a university course; (2) keen competition on the part of certain branches of industry to secure students as soon as they had graduated; (3) a period of training in research does not receive full recognition as "responsible" work in the regulations governing qualifications for membership of most of the institutions of engineers.

The trouble is that training for the engineering profession, like that for the medical profession, is now so long, complex, and expensive, and at the end of it the rewards for applying the little that is known are so much greater and more secure than the rewards for exploring the unknown, that the skilled investigator has little encouragement to follow his natural bent. The subject will receive the Council's further consideration during this year.

Research Associations.

Most research associations derive the greater part of their income from industry by means of voluntary contributions made by their constituent members. There is no doubt that the associations would benefit greatly if some equitable form of levy could be substituted. It will be remembered that the Research Association of British Rubber Manufacturers was instrumental in introducing into Parliament a Bill which provided for a statutory levy on all imported—and retained—rubber for the purpose of financing its co-operative research. This Bill, though strongly supported, eventually failed to pass the House of Commons owing to pressure of Government business, and no opportunity of reintroducing it has yet occurred. Incidentally, this unfortunate failure put the Association in a critical financial position, from which it was only rescued by a special grant from the Department under appropriate conditions. Undeterred by this temporary failure, the Councils of many other associations are exploring the possibilities of similar schemes, but not necessarily on a compulsory or statutory basis.

Members of the Department's Industrial Grants Committee recently met representatives of the various sections of the woollen and worsted trades in conference at Bradford to discuss the best means of maintaining the British Research Association for the Woollen and Worsted Industries on adequate lines. The outcome of the conference was a resolution requesting the wool textile delegation to appoint a committee to go fully into the matter, and, if possible, to frame a levy scheme applicable to the conditions of the industry. This committee has met, and we understand has now reported unanimously in favour of a scheme which has been submitted to the various trade federations for approval. The scheme which will be national in its application will, if adopted, be imposed as the voluntary wish of the trade.

Other associations which are exploring the possibility of levy schemes include the Electrical, Linen, Non-ferrous Metals and the Cocoa, &c., Research Associations, but it is too early to judge whether a satisfactory solution of the various practical difficulties will be found. Probably the simplest case is presented by the British Electrical and Allied Industries Research Association which, during its period of existence, has carried out many investigations of unquestionable value to the electrical supply industry. An appeal which has the support of the Electricity Commissioners, the Central Electricity Board, and the Institution of Electrical Engineers, has been made to supply undertakings, asking them to contribute individually on a basis of a subscription of £10 for each £25,000 of annual revenue derived from sales. Under the proposed scheme, the general control of the Association will be rearranged, so that the supply section takes its proper share in directing the operations of the Association. One of the difficulties in organising a fully co-operative research association has been that of uniting the interests of makers and users in an effective manner. In the electrical industry this difficulty seems likely to be overcome.

In 1925 approval was given to an exceptional arrangement whereby the Department agreed to pay the British Cutlery Research Association a grant of £1000 a year for five years from January 1st, 1926, on condition that an equivalent sum was subscribed by members of the Association, and an additional grant of £2000 a year, without any trade equivalent, on condition that the total amount of the additional grant should be repaid eventually from royalties received from the purchase of machines devised by the Association. The reasons why the British Cutlery Research Association received such exceptionally favourable terms at the time were—(1) the trade was in an extremely depressed state; (2) the Council was advised that the substitution of automatic machines for hand operations in many branches of the trade would be of great benefit; and (3) the then Director of Research was exceptionally fitted, and had exceptionally good facilities, for the design and development of machines of this type.

Unfortunately, three years' experience showed that our hopes were not likely to be fulfilled, and in particular that there was little possibility that the additional grants made by the Department would ever be repaid out of royalties on machines. The contract was therefore terminated by mutual agreement during the past year, but, at the request of the Association, the Department will continue to pay for the remaining two years of the period a £1 for £1 grant, limited to £500 a year, to enable the Association to continue some work of interest. The reason for the failure of the Association must, the Council thinks, be attributed to the peculiar organisation of the industry, rather than to any shortcomings on the part of the Director of Research, who, faced with a difficult task, has attacked it throughout with energy, ingenuity, and enthusiasm. When a machine, apparently quite successful from a technical point of view, is objected to by cutlery manufacturers because of its high capital cost, and when that cost is only a few hundred pounds, one begins to realise how great are the difficulties in bringing about the introduction of improved methods in this old-established industry, organised as it is at present. It may be that it will continue to enjoy a measure of prosperity under existing conditions. The Council is not sufficiently informed to express an opinion as to whether, in the cutlery trade, large units of production will be more economical than numerous small units; but after the experience of the last few years, it ventures the opinion that so long as the industry is organised in small units, scientific research is not going to assist it much except by the provision of better steels and materials, and these are continuously being improved as the result of the work of the chief research laboratories of the steel industry.

The British Empire is rich in minerals, many of which have received little or no attention from the industrial point of view. Powerful British companies control the output of other minerals from foreign countries. Of all countries, Great Britain ought to take the lead in the investigation of the industrial uses of new metals and alloys, yet we seem, the Council says, too content to allow such developments to take place in foreign countries. To take a concrete example, the alloys of magnesium have been intensively investigated in Germany for some years, and they are now produced and used on a large scale. Inquiries showed that although these alloys were being made *under licence* in this country, no industrial research was taking place or was likely to take place. In view of the special importance of light alloys to the aircraft industry, and therefore to the Air Ministry, the Council accepted a recommendation of the Metallurgy Research Board that a general research on magnesium and its alloys should be started at the National Physical Laboratory. The Council does not, however, hide from itself the conviction that the results of such an investigation, however interesting, will be of doubtful practical value to British industry unless they are linked up with production through investigations on an industrial scale and under industrial conditions.

A High Voltage Testing Laboratory.

In the cable-testing department of Siemens Brothers and Co., Ltd., of Woolwich, the English Electric Company has installed an interesting testing plant for the testing of single-core cables for working pressures up to 76 kV to earth, *i.e.*, cables suitable for 132 kV three-phase systems and of three-core cables designed to operate at 66 kV between cores. Unlike other testing equipments, those for cable work are required very largely for measurements and not merely for breakdown tests, and the plant under consideration is designed for making measurements and other testing work at pressures up to 100 kV and for breakdown and flash-over tests,&c., up to a pressure of 450 kV. On account of the necessity for accurate measurements of small losses at very low power factor, the voltage wave form must be free from harmonics, a requirement that renders it desirable that the whole plant, including the source of supply, should be designed as one unit. The three areas of the testing department are surrounded by expanded metal screens 7ft. high, with a single gate in each case. The large central area contains all the high-voltage apparatus, and the end compartment adjacent to the high-voltage transformers forms the sample testing area, in which breakdown and flash-over tests are carried out, and contains a pit for steam-heated oil tanks, whilst the other end compartment is for routine and cable heating tests, carried out on drums of finished cable, which may either be on the floor, supported on insulated trestles, or immersed in steam-heated tanks. Provision is also made for testing lengths of cable in an outdoor concrete trench, which may be filled with soil of various kinds. The side of the enclosures is bounded by a wall of the building, whilst along the other side is a gangway from which the staff may read the various instruments within the enclosure either by means of telescopes fixed to the screens, or on transparent scales from reflecting instruments. The machine room, regulator room and stores are situated between the gangway and outer wall, and above these departments is the control gangway and office, from

which the whole of the testing areas can be viewed. A general view of the testing area, as seen from the control gallery, is given in Fig. 1.

Power for operating the testing equipment is provided by a 525 kVA, 550-volt single-phase alternator, driven by a three-speed alternating current motor, which enables frequencies of 50, 37·5 and 25 cycles per second to be obtained, and by making tests at these frequencies it is possible to deduct the performance of a cable at any commercial frequency. In the design of the alternator care was taken to ensure a good wave form and to suppress the principal harmonics, which are introduced by the varying permeability of the cores of the testing transformers during each cycle. The field strength was also proportioned to maintain stability under the capacity load which cable-testing introduces, and as the stability of the equipment is greatest when the alternator field is maintained at its normal value, the voltage applied to the primaries of the testing transformers is varied from 0 to 1100 volts by means of an auto-connected induction regulator through which the supply is taken. Experience has shown that the wave form is not distorted by induction regulators of the English Electric Company's design. The regulator is motor-operated on the remote control system and interlock contacts prevent the transformer being connected in circuit unless the regulator is in the minimum voltage position.

The transformers were specially designed for high-voltage testing work, the high-voltage winding consisting of paper-insulated wire specially treated during manufacture, whilst the main insulation is composed of fullerboard. The transformer bushings are of the condenser type. For making pressure measurements alternative equipments are available. A horizontal sphere gap, having duralumin spheres 500 mm. in diameter, is motor-operated from the control desk, while the counter shows the distance between the spheres in millimetres and a check scale is provided on the base of the sphere gap. Whilst, however, the sphere gap is a standard device for measuring high voltages, it is subjected to certain vagaries when used under conditions which are not ideal, and direct reading measurements are, therefore, taken for both effective and crest values of voltage.

FIG. 1—GENERAL VIEW OF LABORATORY FROM CONTROL GALLERY

FIG. 2—POTENTIAL DIVIDER FOR VOLTMETERS

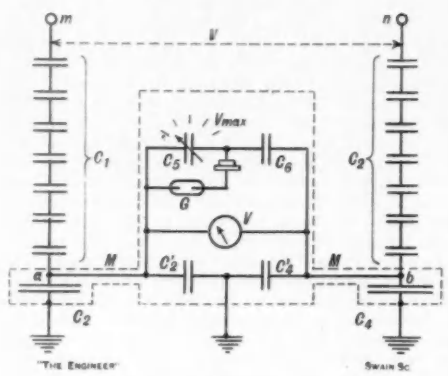


FIG. 3—VOLTMETER CONNECTIONS

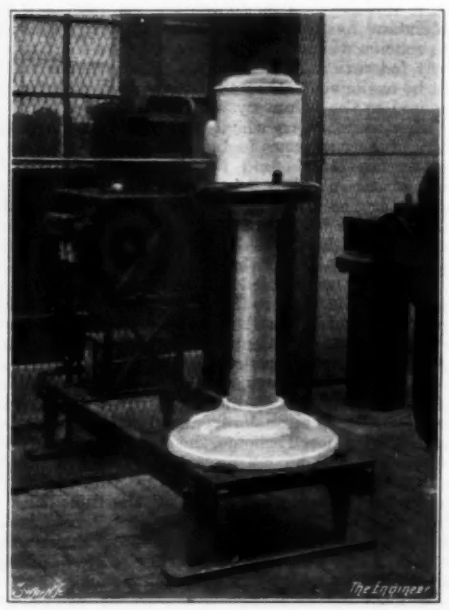


FIG. 4—OSCILLOGRAPH

For this purpose a potential divider, as shown in Figs. 2 and 3, is used. It consists of a series of metal-coated porcelain condensers, and a large diameter guard plate on the top serves to equalise the potential across the individual sections. In the base there is a mica condenser having a capacity that is large compared with that of the porcelain condensers, and across this mica condenser an electrostatic voltmeter is connected. Crest voltage is measured by the striking voltage of a Neon tube shunting a variable condenser across the same terminals as the electrostatic voltmeter. This system of voltage measurement is independent of atmospheric conditions and dust accumulation, which have a marked effect on sphere gap measurements. For observation and recording of wave form up to the limit of the measuring instruments, *i.e.*, 100 kV, an oscillograph has been provided. The vibrators of the instrument are contained in the porcelain structure—shown in Fig. 4—whilst the cinematograph film camera, automatic feed arc lamp and observation mirrors are on the safe side of the expanded metal fence.

High-voltage tests can be applied, with the equipment, to cables which are carrying a current corresponding to their working, or other load. For this purpose a 50 kVA, 300-ampère, 167-volt loading transformer is provided with its secondary winding insulated for 100 kV from earth. The cable current is led through a resistance measuring cupboard—see Fig. 5—which contains a 2-volt heavy traction type accumulator, together with a standard 0·01 ohm shunt, a hot-wire ammeter and voltmeter, a reflecting galvanometer insensitive to commercial frequencies, a reflecting astatic wattmeter and switching arrangements. With this arrangement it is possible to compare the galvanometer deflections across the cable and shunt, and so plot the temperature rise of the cable against time. The true watts may also be read and the eddy current and sheath losses may be deducted. Much valuable information may therefore be gained under working conditions. The connections are shown in Fig. 6, where the two centre instru-

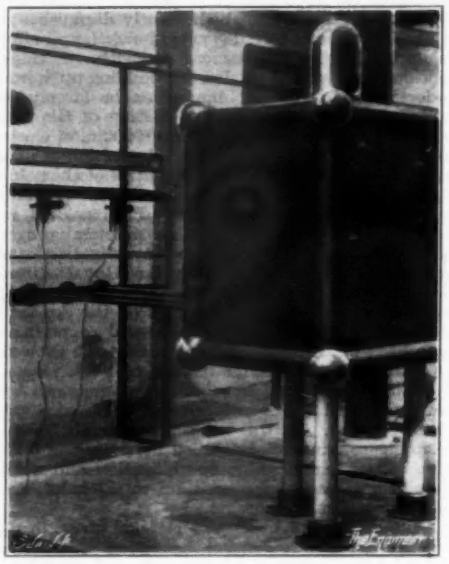


FIG. 5—RESISTANCE MEASURING CUPBOARD

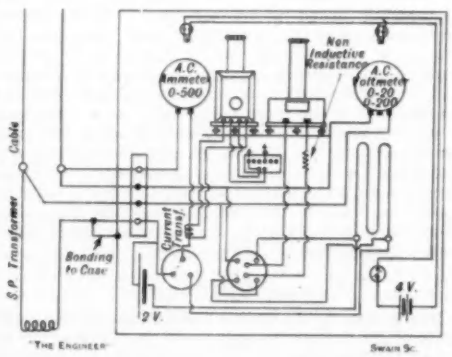


FIG. 6—DIAGRAM OF RESISTANCE MEASURING CUPBOARD

FIG. 7—0·25 MEGOHM RESISTANCES

ments are the wattmeter and galvanometer. In testing cables for very high voltage an important matter is the measurement of dielectric losses, which is really of far greater importance than breakdown tests on samples and can be carried out on the completed cable ready for service. Appreciable increase in dielectric loss, or the loss not returning to its original value when the temperature is reduced or increased, dielectric power factor with increased applied voltage would all point to ionisation or other

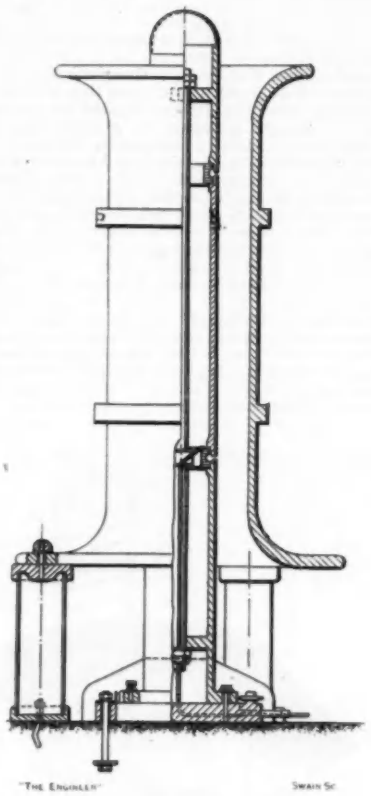


FIG. 8—STANDARD AIR CONDENSER

troubles which would render the cable unsatisfactory in use. Losses in the dielectric cause the leading power factor to be slightly above zero, corresponding to the small watt component of the current. The power factor and losses to be measured are so low that if accurate values are to be obtained every care must be taken to see that they are not modified in any part of the circuit. For the measurement of dielectric loss a Duddell-Mather wattmeter and Schering Bridge have been provided. Until recently the wattmeter was the only instrument used for loss measurement, but the difficulties of measuring losses at power factors of 0·004 are very great, as the phase angle is less than 0° 14″ from true quadrature. Potential transformers are obviously useless, as the phase angle is normally about double that amount and the loss measurement may be as much as three times too high, or, actually reversed, according to whether the wattmeter current coil is in the high voltage or at each end of the transformer. For this reason, Mather woven-gauze resistances have been employed for high-voltage potential dividers. Self-capacity in the resistance and the capacity to earth have, however, led to other phase troubles. It was found that much of this phase displacement was caused by capacity coupling, owing to the resistance gauze being mounted on angle iron framework in steel tanks, and the English Electric Company has, therefore, evolved a design in which teak wood supports and a circular bakelised paper tank are used, the only metal parts being the resistance wire and terminals. Fig. 7 shows two of the four resistance tanks associated with the plant under consideration, each containing a 250,000-ohm oil-immersed resistance.

The wattmeter is, however, only used for routine tests and for comparative purposes, accurate measurements being made on the Schering Bridge, which consists of a mixed load of capacity and resistance with an adjustable "pure" resistance balanced against a "pure" condenser and adjustable "mixed" capacity and resistance. The needle-type vibration

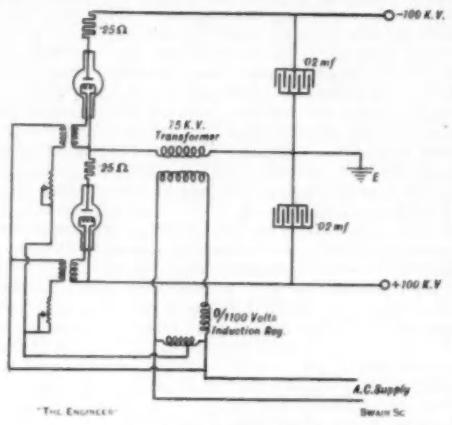


FIG. 10—CONNECTIONS FOR 200-kV TESTING EQUIPMENT

galvanometer is very heavily screened magnetically. The "pure loss-free" condenser—see Fig. 8—consists of concentric cylinders with air dielectric, and is designed for use at pressures up to 120 kV. The castings were machined and ground to a high degree of precision at the company's Rugby works, and six months were allowed to elapse between the time of first rough machining and the final grinding in order that all distortion due to casting stresses might have time to settle out between the various machining processes, and so that a permanent laboratory standard condenser might be obtained. For the same reason glass distance pieces were used between the centre electrode and its guard rings. The condenser has a capacity of 0·0001 microfarad and weighs, approximately, 1¾ tons. The values in the arms of the bridge are calculated so that the power factor and capacity of the dielectric to be measured are direct, and accuracy to within 0·0001 radian phase angle is obtained, or 0·25 per cent. on a dielectric

FIG. 9—DIRECT-CURRENT TESTING EQUIPMENT

of 0·004 power factor. For small angles up to about 4 deg. the sine, tangent and radian measurements are also made to four significant figures, and the power factor and the loss of a dielectric are, therefore, expressed as an angle of displacement, *i.e.*, on a decimal fraction of a radian, and that quantity is known as the phase angle of the dielectric.

As much information can be gained from the electrification curves of cables obtained by high-voltage direct current testing, an equipment is included in the laboratory for testing at a direct current pressure of 200,000 volts. The equipment consists of a 5 kVA, 550/0–1100-volt induction regulator, which feeds a 75 kV transformer, and full-wave rectification is obtained by means of two thermionic valves protected against damage by a 0·25 megohm "Sitit" resistance in the anode circuit. A view of the equipment is given in Fig. 9, whilst Fig. 10 shows the electrical connections. As at times the testing load consists of short samples of cable, or joints, it was necessary, in order to smooth out the voltage, to provide 100,000-volt condensers, which are of the English Electric Company's mica-insulated and oil-immersed type.

All the bus-bars and switching arrangements had to be supported from the floor in order to allow the overhead crane to pass over the testing area. The bus-bars are composed of brass tubes, 2½in. in diameter, and there are metal spheres, 8in. in diameter, at all connections. Many of the connections are arranged to swing round so that they may be used on either of the two sets of bus-bars as occasion demands. The supports are composed of bakelised paper tube with massive corona rings at each end, the design being such that any flash-over takes place quite clear of the tube. All supports, screens and structural work are solidly earthed, and control circuits and metallic structures containing high-voltage apparatus are held at a definite potential. The careful lay-out of the plant and the considerations given to these apparently minor points have resulted in freedom from brush discharges and quiet operation. Red warning lamps are mounted on the screens and control panels, and interlocks are provided so that it is impossible to close the main oil switch until the gates are closed, the crane is at the safe end of the test room, the bus-bars are de-earthed, the induction regulator is in the minimum voltage position, and the alternator bus-bars are at normal voltage. A remote-controlled motor-operated switch serves for earthing all the three bus-bars, whilst magnetic bolts make it impossible to open the gates until the plant is earthed. Indicator lamps on the control desk show the position of the main induction regulator, and that of the heating load regulator, which is provided with alternative automatic control to maintain a constant current on the cable without attention.

It is believed that this is the most complete flexible and most up-to-date high-voltage cable testing equipment at present in existence.

Experiences with the First "Wood" Steam Generator.

MR. WATSON SMYTH'S paper on the "Wood" steam generator, which is being published in our columns, was read and discussed at a meeting of the North-Western Branch of the Institution of Mechanical Engineers in Manchester on Thursday, January 23rd. There was a large attendance of members and visitors and the discussion was of more than average interest. Mr. Guy, who presided, in moving a vote of thanks to the author, said that in presenting a subject of that kind dealing with a basic development Mr. Watson Smyth was doing valuable service to the Institution and to engineers by telling them of the difficulties they had met and how they were overcome.

In the discussion, Mr. H. G. Partridge said that comparing the Wood boiler with what had been done in other directions, the results did not show much advance. A plant with which he had to deal had an evaporation of some 60,000 lb. to 75,000 lb., and a total heating surface of 22,920. That compared quite favourably with the figures given in the paper—28,240. He knew of one boiler in which the total transmission surface was 58,900, the total evaporation 300,000 lb., and the chimney temperature 208 deg. He did not know whether he was right in taking the concluding figure of 53,000 lb. given in the paper as an operating condition, which rose occasionally to 80,000 lb. That figure was not out of the way as ordinary boilers went. It was considerably lower than the figures they had expected, in view of the American figures which had been brought over some years ago.

Mr. J. E. Braham thought that the method of giving the gases a sweeping motion round the combustion chamber must lead to the lodging of partly burned particles on cooling surfaces, and result in some quenching of those particles, and he asked if the author had tried straight-through burning at any stage during the tests. Reference was made in the paper to the coal particles being given a longer time to burn in the combustion chamber, owing to the rotary motion of the gases. Providing the load on the boiler was constant and the CO_2 conditions unchanged, it seemed to him that practically no alteration in time of passage through the boiler could result, since the gas volumes were the same.

Mr. F. Jones said that, according to a chart given in the paper, 90,000 lb. per hour evaporation was a straight line. The average load would appear to be about 53,000 lb. Was the generator capable of maintaining 90,000 lb. for an hour period? Another feature of the generator described was that the gas flow in the combustion chamber was downwards, as opposed to all the other types of boilers he had ever seen. Were any temperature measurements taken inside the combustion chamber, and how did the transfer

actually given in those tests compare with what could be expected from the laws of radiant heat ?

Mr. Carey asked if the evaporation of 90,000 lb. was for continuous operation. If so, the limit so far as the heat transfer was concerned on the water side had probably been reached. If it was carried very much higher the temperature would be so high that the tubes would be burned out, if there were the least imperfection. That, of course, had been appreciated on the Continent, where boiler designers tried to get over the difficulty by circulating steam instead of water. He also asked what was the exact mechanism of the burning of pulverised coal. There was not a great deal published on the subject. The present results seemed to indicate that the particles had to be heated up to some temperature of the order of 500 deg. or 600 deg. Cent., after which they ignited very rapidly. He noticed, too, that Mr. Smyth had used very highly preheated air. He did not know whether that was partly a substitute for the radiant heat chamber, which was sometimes used with pulverised fuel burners and produced very much the same effect. A very large air heater was used. It had the effect of diminishing the surface in the combustion chamber, and so cheapening the total cost of the boiler ; but various troubles, owing to the effect of using very highly preheated air—such things as oxidation of the surfaces—were not uncommon.

Mr. R. W. Seymour said it had been stated that the temperature of steam in the superheater was about 1000 deg. Fah. It had been pointed out that tubes at that temperature would be a dull red heat. Would Mr. Smyth tell them the period during which the superheater stood up to such stringent conditions ?

Mr. C. E. Stromeyer said he did not know which to admire most, the boiler itself or the paper. It had been mentioned several times that various difficulties had been encountered, and the paper was a lesson to anybody who had to deal with boilers. He had no questions to ask, and no comments to make. One or two points had been raised by members which, he thought, he could answer, and so save the author from doing so. One was about the quantity of air passing through the combustion chamber, and whether the swirling did not reduce that quantity. The swirling made no difference to the quantity that passed through, but it necessitated that the velocity with which the air was introduced into the boiler must be greater if it had to circulate, and that high velocity was a great advantage. With regard to increasing the size of the boiler, he thought that it was desirable to sound a note of warning. As the boiler was based on radiant heat activity, the larger the diameter of the chamber, the more difficult it would be for the radiant heat to leave the centre and go to the circumference, but by increasing the height of the boiler that difficulty might be overcome. He believed, however, that the diameter and the length had an influence on each other, and he thought it would be well, before advancing to larger dimensions, to study the question as to how far they did affect each other. Thirty or more years ago he had drawn attention to the necessity of considering radiant heat with regard to the heat transmission in the boiler. When he had first written his book on marine boilers, he had studied some French experiments on a subdivided locomotive boiler. Those experiments had been extremely puzzling then—one quality of coal had given a tremendous evaporation in the fire-box and another had given hardly any in the fire-box. It had dawned upon him some years afterwards, when he had read a paper on Radiant Heat to that branch, that those discrepancies were due to more radiant heat being given off by one fuel than by another, and he had drawn attention to those experiments. Very shortly afterwards, he had come across the radiant heat theory, and had mentioned what must happen if radiant heat were taken into account.

Mr. H. R. H. Ward said that he could perhaps also answer some of the points which had been raised by other speakers. One speaker had asked for some information about future boilers, which he quite rightly thought had emanated from the design of the Manchester boiler, such as those at Derby and Brighton. He would tell them a little about the Brighton boiler first.* It was almost exactly the same as the one Mr. Smyth had told them about. Certain points which had been learned from experience with the Manchester boiler had, of course, been made use of in the design of the Brighton boiler. For instance, the water screen had had its heating surface considerably enlarged. There were nine rows of tubes instead of two complete rows and two half rows. There was therefore just over twice the amount of heating surface. That reduced the temperature of the gases sufficiently to put them into the superheater. After leaving the superheater, the gases were at a temperature of about 800 deg., when they went through the air heater. The arrangement of combustion was exactly the same as at Manchester. In the Derby generator, things were rather different. It was not fired by what they termed corner firing. There was a central burner in the base of the combustion chamber, which projected the coal up through the water screen and spread it out. That had so far not given such good results as corner firing. The heavier particles hung back, and a lot of them fell through the water screen ; but the pulverising at that station was very coarse. At times they were only getting from 40 to 45 per cent. through a 200 mesh. The gases passed up through three rows of tubes in the roof of the furnace. The superheater was situated there, and after passing through it the gases went directly into the economiser, down through the economiser to the air heater. So the gases left the plant in that case at ground level instead of at the top. It had been decided that that was a better method of planning, but in future boilers corner firing would probably be resorted to instead of the central burner. One of the great advantages of having as high a preheated air temperature as possible in a radiant heat boiler was the fact that only a slight increase in temperature of the combustion chamber—the ignition temperature—made a very big increase in the amount of heat that could be taken by radiation. The rate of transfer of heat by radiation was as a fourth power of the absolute temperature.

Mr. A. N. Harrison-Slade said that great interest was being displayed in the use of low-grade coals, and if one could not use coal with more than 6 per cent. of ash in it in that type of generator, a very severe limitation on its use must be imposed. He would like to ask Mr. Watson Smyth whether it had been found possible subsequently to use coal with a much higher ash content, and to what extent that had increased his troubles. It seemed to him obvious, from Mr. Smyth's remarks about the repeated alterations to the heating surface affecting the superheater, the economiser, and the air heater, that more, at any rate, remained to be known about the transfer of the radiant heat in the boiler, so that one could correctly apportion the heating surface, not only in the boiler, but in the other parts.

Mr Lunn said he had noticed that a high calorific value coal was used. Engineers had been told years ago that an advantage of pulverised coal was the use of coal with a low calorific value. If they had to put in pulverised plant with all the economisers, and still had to use coal which they could very efficiently burn on a chain grate stoker, there was not much of a case for pulverised fuel.

In replying briefly to the discussion, Mr. Smyth said the superheater had lasted to the present day. The floor space occupied by the boiler was 336 square feet and the height of the building to the eaves 33ft. He defended the pulverisation of pure coal. With regard to the query of one speaker regarding the combustion chamber being a radiant heat chamber, he said it was entirely of that kind, and as concerned the evaporation figure of 90,000 lb., he said that tests had been run at that figure over a long period, but generally the works did not require such a high load for any length of time. Theirs was a steel works and they had big rolling mills, so the loads were very fluctuating. The boiler was a 90,000 lb. boiler, and could be run at an efficiency of 82 to 83 per cent. day in and day out. When the tests had been taken, the blow-down of the water had not been taken into consideration because the boiler had never been blown down during the tests. Several speakers had asked about the oxygen. They had known when they had put in a steel tube economiser that they would have trouble, but they had wanted to test it out. He had given it six months' life, and it had lasted exactly six months. The oxygen content of the water was 7 c.c. per litre, *i.e.*, town's water. The average content of feed water leaving the de-aerater varied between 0·03 c.c. and 0·1 c.c. per litre. The average feed temperature was 100 deg. to 110 deg., and the outlet temperature was 130 deg. to 140 deg.

* This boiler was fully illustrated and described in THE ENGINEER of May 24th, 1929.

Wagon Retarders for Shunting on Railways.

THE mechanical braking of wagons by side pressure on the wheels originated, over thirty years ago, in Germany, and was later used in France. Some ten years or so ago it was adopted in the United States, and last year saw the first installation in this country. Wagons are also mechanically braked by means of rail slippers on to which the wheels mount and ride. The present article describes a system of the latter character to be found on the French railways.

Shunting on railways is an expensive item. The consumption of engine power in shunting goods wagons may be measured by the fact that whilst goods locomotives are earning, *i.e.*, engaged in traffic, for 18 million engine-hours in a year the time spent in shunting wagons is 22½ million engine-hours a year. The total distance run by engines in goods shunting is 113 million miles a year, which is very near the 144 million miles run yearly by goods trains. There are 18,000 shunters employed on British railways, but, of course, not wholly on goods, and the companies pay away £4,000,000 in wages alone for shunting. The latter figure includes all grades employed on that work and not only the actual shunters. We say truly, therefore, that shunting on railways is expensive.

There are also two methods of shunting—by mechanical means and by gravity. The first gravitational shunting yard in this country was laid out in the Tyne Docks at Jarrow. Hump shunting, wherein wagons are propelled on to the summit of an artificially made steep incline—known in France as *dos d'âne* (ass' back)—and when detached run down a sharp, steeply falling gradient, was, it is believed, first adopted at Speldorf in Germany in 1876. It soon became very popular in that country and in France. The method was first employed in the United States in 1882, when a yard on that principle was constructed by the Pennsylvania at Huffs, in Virginia.

The first hump yard in this country was that of the Midland Company at Toton, at the southern end of the Erewash Valley. It was opened in 1901 and deals with 8900 wagons a day. More modern yards were later provided at Wath on the Great Central and at Feltham on the Southern. The former of these two was opened in 1907, and deals with 5000 wagons daily. Feltham was brought into use in 1921 and handles 3500 wagons a day. Both these are modern, in that the points are operated electrically. Wath was the first such place where track circuit controlled the operation of the point levers. The Whitemoor marshalling yard on the London and North-Eastern was opened in 1928.

It was obvious that, with a sharply falling gradient, of at least 1 in 50, the wagons, when they left the hump and entered upon the ladders leading to the various sidings, would be running at a high speed and that that must, in most instances, be checked in order to avoid damage to rolling stock and to the contents of the wagons by severe impact with other wagons. On the European Continent it was considered sufficient to have a slipper or skid, which was placed by hand on the rail, at a point suitable to the speed of the oncoming car, and received the leading near-side wheel of the wagon. The slipper checked the speed of the wagon and at a certain point the slipper was automatically thrown off the rail.

Then came the mechanical braking of wagons by means of what are known as retarders, of which the two principal signal companies in the United States—the Union Switch and Signal Company and the General Railway Signal Company—have types, and there is the German method associated with the name of Dr. Frolich, a German railway

FIG. 1—CONTROL CABIN

officer. It is the last-named that is used at Whitemoor Yard.

The latest development in the slipper system is that which has been in work for five years in the yards of the Northern Railway of France at La Délivrance, Lille. It is the invention of M. Deloison, chief of the locomotive running shed at Lille, and M. Deyon, his foreman. The slipper is normally kept in a pocket, or, as it is called, a throw-out, and is drawn out and conveyed along the running rail to meet an approaching wagon by means of a motor-operated endless cable. The motors are switched in by an attendant in a control cabin, who watches the progress of the wagon and causes the slipper to brake the wagon for a distance suitable to the speed and the distance the wagon then has to travel.

The yard is an entirely new one and, along with the colony built by the railway company around it, is known as La Délivrance in commemoration of its recovery from the Germans in 1918. It is entered from the northern end, where there are ten reception roads—to be increased later to fourteen. These roads are about 650 yards long, laid on an easily falling gradient towards their southern end, where they converge into four roads, which give access to thirty-seven sorting sidings, which are laid on the level. At the southern end of the sorting sidings are three necks into which trains, after having been made up in the sorting sidings, are drawn and then propelled into the departure sidings, twenty-three in number, whence they depart at the northern end of the yard. The shunting is entirely gravitational, not by a hump, and two parallel shunting movements are possible at the same time.

The signal-box which controls the wagon movements and actuates the points is Cabin No. 4 and is erected across the lines at the southern end of the reception road, at the point where they converge into four roads. It contains seventy-eight levers in an Aster all-electric locking frame. There are thirty-seven sidings, of which Nos. 1 to 20 inclusive are on the west of the control tower, and Nos. 21 to 36 are on the east. No. 37 was evidently numbered later, as it is to the west of No. 1.

Fig. 3, p. 162, is a view of the yard taken from Cabin No. 4. The two lines on the extreme right are engine-shed roads.

The double slips on the right, when set to the right, lead to road No. 37 and roads Nos. 1 to 11 inclusive, and, when made for the left, to roads Nos. 12 to 20 inclusive. The double slips on the left take similarly Nos. 21 to 30 and Nos. 31 to 36. The control tower is in the centre of the picture. The view given in Fig. 4 was taken from the control tower and looks east. In the foreground are the two connections that lead to sidings Nos. 21 and 22, and Nos. 23 and 24 respectively. Beyond are two other connections, each leading to a set of three sidings—Nos. 25, 26, 27 and Nos. 28, 29, 30. East of the shunters' hut are the three sidings Nos. 31, 32, 33, and then Nos. 34, 35 and 36. In the distance are seen the departure roads into which the wagons, in complete trains, subsequently find their way.

Coming now to a description of the operation of the slippers, it should be noted that in future installations the control will be in the same signal-box as that which actuates the signalling, provided a new signal-box has to be erected for the signalling. At Lille Cabin No. 4 was in existence and did not need a change. There was not, however, room therein for the retarder controlling apparatus, so an independent control tower was provided, of which Fig. 1 is an exterior view, and Fig. 5 an interior view looking towards Cabin No. 4. There are, it will be seen, three controlling frames, at each of which a man works.

There are twenty-nine retarders in all, one of which can be seen clearly in Fig. 6. The western sidings—No. 37 and Nos. 1 to 20—need only four, which are placed immediately south of the double slips on the right in Fig. 3 before the four roads seen spread out into twenty-one lines. It has been found that one braking is sufficient for those lines. For the roads Nos. 21 to 36 it has been necessary to have two and sometimes three brakings. The first is given in the three roads immediately south of the double slips seen in Fig. 3. Then there are six brakings after the three roads have become six, and afterwards there can be a final braking at the fouling point inside each of the sixteen sidings. The number of brakings

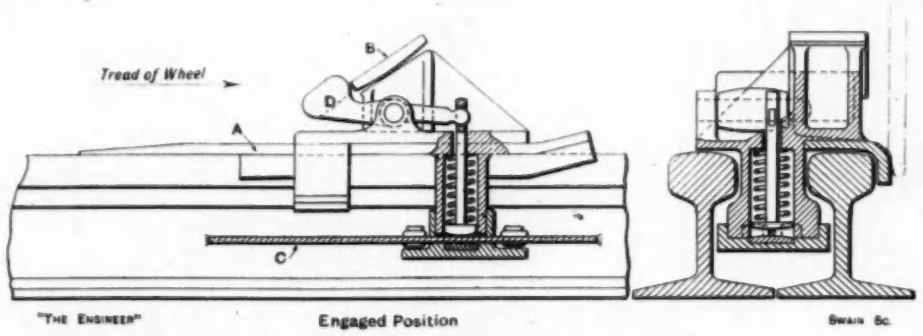


FIG. 2—ARRANGEMENT OF SLIPPER AND CARRIAGE

considered necessary depends on the loading of the wagon—some wagons are of 30 tons capacity—the speed, and the distance to be travelled along the siding before it reaches the other wagons in the siding.

Each wagon, or string of wagons, as it leaves the reception sidings, has chalked upon one of its leading buffers the number of the siding into which the following shunt has to be made, *i.e.*, an approaching wagon, although it may be going into No. 12 road, would show "17" on the buffer if the immediately succeeding shunt is to go into No. 17. That information is given mainly for the signalman in Cabin No. 4 in order that he may set his points to suit. It also enables him to cause an illuminated numeral to be exhibited for the information of the men in the control room and of shunters and others in the marshalling sidings.

As already said, there can be parallel shunting from the reception lines into the marshalling sidings, and for that reason there are two illuminated signs, one over the box for movements from the west side of the yard, and one to the east of the box for shunts from that side. These indicators are also used for conveying special instructions to the men in the marshalling sidings. Thus, a red horizontal sign calls for working to be stopped; a similar indication in blue intimates that work may be resumed. A red diagonal sign, from upper left to lower right, signifies that a crossing is fouled. When wagons that contain fragile articles are being shunted, a similar indication is given but in blue. The approach of a long string of wagons unaccompanied by a man in charge, which, therefore, must be handled with care, is intimated by a vertical red sign; if accompanied, the vertical sign is blue. These indications, like colour light signals, are as visible by day as by night.

It may conveniently here be added that the yard is well lighted. In that connection it may be noted that the slippers are painted white and so can be readily seen by day or night. It is unnecessary to describe the electrical connections in detail. It is sufficient to say that a dial is provided in the control room for each road. This dial shows travel of the carriage and slipper in metres, and is set at the discretion of the operator. Having set the dial he closes a switch and the carriage is hauled out of the throw-out or pocket forward by the cable to meet the oncoming wagons. As it is carried backwards by the wagons, the dial indicator is reversed, so that the operator can follow the movement.

As at first arranged, the operator could move the carriage, with its slipper, forward, to meet an advancing wagon, as far as he considered desirable, but should he find that he had sent it further than was necessary, and so was giving a longer braking distance than conditions required, he could not draw it back. The improvement now made retains the carriage and its slipper under the control of the operator, to move as he thinks fit, until the wheel actually is on the slipper. The slipper and carriage are shown by Fig. 2, where A is the carriage riding between the rails, and B the block on the slipper against which the wheel presses. The cable is marked C. It is gripped by a spring-loaded plunger as long as no wheel is in contact with the slipper and the carriage can therefore be moved backwards and forwards at will. When, however, a wheel depresses the lever D, the cable is released and the slipper is then pushed along the rail. As soon as the wheel leaves the slipper at the throw-out the cable is again gripped.

Added to the great benefit the improvement has brought that the slipper can now be moved backwards as well as forwards, at the will of the controller, there is satisfaction in the fact that the track circuits, with their contacts, relays, &c., which were necessary until the improvement was made, are dispensed with, an economy in first cost and in maintenance and renewal.

An interesting feature is that bogie wagons can have two brake applications. After the slipper has been passed into the throw-out by the leading wheel of the first bogie, it can be brought forward in time for an application to the second bogie.

Inspection of the rails at the retarding points show that the heads are not worn, nor have there been any complaints as to flats on the wheels. That, it may be remarked, is only in keeping with the experience elsewhere of slippers which have been used for the last 30 or 40 years. A shoe will handle 3000 wagons before the nose, or cushion, need replacement. Those parts are then cut off and a new shoe or cushion welded on by the oxy-acetylene process. A supply of slippers lies near the retarders ready for use when occasion arises. At La Délivrance yard 4200 wagons are shunted into the marshalling sidings during the 24 hours.

The Deloison system, as exemplified at Lille, is applied to a natural gravitational yard, but it is equally applicable to hump shunting. An installation of the latter type was brought into use in 1926 at Metz-Sablon, on the Alsace-Lorraine Railway, and there the gradient of the hump is 1 in 16. That is more severe than at Whitemoor, where the hump is 1 in 18.

In addition to the installations of the Deloison system at Lille and Metz there has been one, since 1925, at Lumes, on the Eastern of France, and plans are under considera-

tion for one on the latter railway at Conflans-Jarny and for another on the Northern of France at Le Bourget.

The British agents for the Deloison system are Tyer and Co., Ltd., of Dalston, E. 8, to whom we are indebted for the diagrams reproduced and for the photographs from which our illustrations have been prepared.

Lloyd's Register: Annual Summary.

LLOYD'S Register "Annual Summary of the Mercantile Shipbuilding of the World for the Year 1929" was recently published and, as has been our custom in past years, we give below a *précis* of its contents. It is to be remembered that this summary does not include warships, and that it takes into account only merchant vessels of 100 tons *gross* and upwards, that were *launched* in 1929, whether they were completed during the year or are still under construction. Sailing vessels fitted with auxiliary power are included with steamers or motorships, according to type of engine. Returns are not available as regards Germany and Austria-Hungary for the war period (1914–18), or as regards Germany for 1919 and 1920.

GREAT BRITAIN AND IRELAND.

Particulars of Total Output—During the year 1929 there were launched in Great Britain and Ireland 489 merchant vessels of 1,522,623 tons, viz., 403 steamers of 1,055,889 tons, 77 motorships of 464,188 tons and 9 barges of 2546 tons. With the exception of two small wood vessels fitted with oil engines, all these vessels were built of steel, and no sailing vessel was launched during the year. The output for 1929 was 76,703 tons higher than that for the year 1928. The present total represents 54·5 per cent. of the World's output for 1929, as compared with 53·6 per cent. for both 1928 and 1927, 38·2 per cent. in 1926, 49·5 per cent. in 1925 and 58 per cent. in 1913.

Nationality of Vessels Launched.—Of the tonnage launched during the year, 1,262,753 tons are for registration in Great Britain and Ireland, and 259,870 tons—17·1 per cent. of the total tonnage—are for owners residing abroad. This percentage compares with 20·2 per cent. in 1928, 21·8 per cent. in 1927, 14 per cent. in 1926, under 16½ per cent. in 1925, and an average of over 22 per cent. for the five pre-war years, 1909–1913. No less than 90,749 tons are intended for registration in Norway.

Size and Type of Vessels.—The returns for 1929 show that 95 vessels of between 5000 and 10,000 tons each and 18 vessels of 10,000 tons and upwards were launched. The largest are the motorship "Britannic" (26,840 tons) and the turbine steamer "Empress of Japan" (about 25,000 tons), which were the largest vessels launched in the World during 1929. Two other vessels of nearly 20,000 tons each were also launched, viz., the turbine steamer "Orontes," of 19,970 tons, and the motorship "Winchester Castle," of 19,950 tons. Excluding vessels of less than 1000 tons, 25 vessels, of 175,009 tons—12 steamers, of 68,092 tons, and 13 motorships, of 106,917 tons—for the carriage of oil in bulk were launched during 1929. Of them, 18 vessels of about 145,000 tons, were built on the Isherwood system of longitudinal framing. Two other vessels of 10,684 tons were also built on this system. The total tanker tonnage, including 4 vessels of less than 1000 tons each, represented 11·7 per cent. of the total tonnage of the steamers and motorships launched during 1929, as compared with 21 per cent. in 1928. The tonnage of steamers fitted for burning oil fuel, launched during the year, amounted to over 306,000 tons. The returns include a number of vessels designed for channel, coasting, fishing—79 vessels—whaling—35 vessels—towing, harbour service, and other special purposes. The average tonnage of steamers and motorships launched during the year was 3167 tons. If the vessels of less than 500 tons are excluded, the average is increased to 4443 tons, as compared with 4656 in 1928, 4193 in 1927, 4486 in 1926, 4439 in 1925 and 3777 in 1924.

Vessels Fitted with Turbines.—Further progress was recorded in the use of steam turbines during 1929, when 15 vessels with a total tonnage of 107,477 tons were launched, which will be fitted with that method of propulsion. In addition, 10 vessels of 58,273 tons, which have a combination of reciprocating engines and low-pressure steam turbines, were launched.

Vessels Fitted with Internal Combustion Engines.—The tonnage of vessels fitted with internal combustion engines is steadily increasing in comparison with the total output. The tonnage of such vessels launched during 1919 was 32,936 tons, while during 1926 it amounted to 201,913 tons, to 355,779 tons during 1927, and 427,916 tons during 1928. During the year 1929, 77 motorships of 464,188 tons were launched, this tonnage representing 44 per cent. of the steam tonnage launched. The largest motorship launched during 1929 was the "Britannic," of 26,840 tons—the largest vessel launched in the World during the year. It may be of interest to note that while the average gross tonnage of the steamers of 500 tons gross and upwards launched during 1929 was 3838 tons, the similar average for motorships reached 6800 tons.

Output of Leading Ports.—The Clyde district occupied first place amongst the shipbuilding centres, showing an output of 532,379 tons. Then followed the Tyne—271,601 tons—the Wear—245,511 tons—the Tees—162,209 tons—and Belfast—143,855 tons. The largest increase, as compared with 1928, took place at Belfast, the figures for which were 68,117 tons higher than those for the previous year. The increase on the Wear amounted to 37,865 tons, and on the Tees to 29,243 tons; the figures for the Clyde showed a decrease of 39,569 tons, and for the Tyne of 28,907 tons.

Progress of Shipbuilding during the Year.—As regards the movement of the shipbuilding industry during the course of 1929, Lloyd's Register Quarterly Returns showed that at the opening of the year, 1,242,794 tons were under construction in Great Britain and Ireland. The returns issued during 1929 showed a distinct improvement during the first half of the year. The tonnage under construction in Great Britain and Ireland at the end of June amounted to 1,453,906 tons. There was a very slight reduction for the end of September, but the figures for the end of December, 1,560,254 tons, showed an increase of 317,460 tons, as compared with the tonnage being built at the beginning of the year. From the Quarterly Shipbuilding Returns it appears that the tonnage commenced during the year—about 1,650,000 tons—more than replaced the tonnage launched, during the same period, from the yards in Great Britain and Ireland, and in conjunction with the above-mentioned figures, regarding the work in hand at the end of December, it would appear that the outlook for the immediate future of the shipbuilding industry of this country is brighter than it has been during recent years.

OTHER COUNTRIES.

Particulars of Total Output.—There were launched abroad during the year 523 merchant vessels of 1,270,587 tons—231 steamers of 448,414 tons, 270 motorships of 805,700 tons, and 22 sailing vessels and barges of 16,473 tons. The total figures show a net increase of 17,268 tons as compared with those for 1928. The largest increases were shown in Japan—60,794 tons—United States—34,706 tons—and Norway—29,203 tons—while in Germany there was a decrease of 127,339 tons, at Danzig of 28,606 tons, and in Denmark of 27,216 tons.

Size and Type of Vessels.—The returns for the year include 51 vessels of between 4000 and 6000 tons each: 33 of between 6000 and 8000 tons; 21 of between 8000 and 10,000 tons, and 16 of over 10,000 tons each, the largest being the motorship "Lafayette," of about 21,500 tons, launched in France, and the turbo-electric steamer "Pennsylvania," of 20,526 tons, launched in the United States. There were launched during the year 12 vessels of a total tonnage of 66,195 tons to be fitted with turbines. This total includes three vessels of 31,526 tons, in which the turbines are used in conjunction with electric motors. In addition, 15 vessels of 69,893 tons were launched which have a combination of reciprocating steam engines and low-pressure turbines. Excluding vessels of less than 1000 tons, the output abroad for the year also comprised 13 vessels, of about 72,000 tons, built on the Isherwood system of longitudinal framing. Including 12 of these vessels of 70,000 tons, there were launched during the year 24 vessels of about 150,000 tons for the carriage of oil in bulk. Of these tankers, 18 of about 107,000 tons are fitted with oil engines. During 1929 there were launched 270 vessels of 805,700 tons to be fitted with internal combustion engines, as compared with 226 of 755,313 tons in 1928. Fifty-one of those launched during the year are of over 6000 tons each, including 15 of 10,000 tons and upwards. Of those exceeding 6000 tons, 11 were launched in Holland; 9 each in Germany and Japan; 7 in Sweden, and 5 in France. The three largest are one of about 21,500 tons built in France and two of about 18,000 tons each built in Holland. The total figures for motorships include a few yachts and other sailing vessels fitted with auxiliary power. Of the steam tonnage launched abroad during the year, about 102,000 tons are fitted for burning oil fuel. The tonnage of wood vessels included in last year's total was only 4903 tons, as compared with 19,484 tons in 1928. With the exception of four sailing vessels of 631 tons, the totals for sailing vessels and barges are

composed of barges, dredgers and similar craft. The countries in which the largest output took place during the year under review were Germany, Holland, Japan, United States, Denmark and Sweden. The totals for these countries amounted to 944,856 tons, and account for 74·4 per cent. of the total output abroad.

Germany.—During the year under review, 85 vessels of 249,077 tons were launched. As compared with the output for 1928, the figures show a decrease of 127,339 tons. The totals still represent 19·6 per cent. of the total output abroad during 1929, compared with 30 per cent. in 1928. The figures include two vessels of 12,080 tons to be fitted with steam turbines, and 14 vessels of 65,186 tons which have a combination of reciprocating steam engines and low-pressure turbines. The total figures comprise, also, 28 vessels of 93,089 tons to be fitted with oil engines, the largest being the motorship "Milwaukee," of 16,699 tons. Three tankers, of 26,217 tons—one a motorship of 8000 tons—were launched. The totals include 12 vessels of between 6000 and 8000 tons, five of between 8000 and 10,000 tons, and two exceeding 10,000 tons each. It may be of interest to state that of the total output in this country, no less than 34 vessels, of 111,576 tons, are intended for other countries, including 13 vessels of 49,086 tons for France.

Holland.—The total tonnage launched during 1929—186,517 tons—was 19,763 tons higher than the 1928 figures, and apart from the record year of 1921, was the highest reached in this country. As usual, the figures do not include craft exclusively intended for river navigation, the total tonnage of which vessels reaches a high figure. Eleven vessels of over 6000 tons each were launched—all motorships—of which five exceed 10,000 tons each, including the "Johan van Oldenbarnevelt" and the "Marnix van St. Aldegonde" of about 18,000 tons each. The totals for the year include 48 vessels of 131,097 tons to be fitted with internal combustion engines, which tonnage represents 70·3 per cent. of the total output for this country. Excluding ships of less than 1000 tons, three motorships of 22,254 tons, and one steamer of 2300 tons are intended for the carriage of oil in bulk.

Japan.—The output for this country—164,457 tons—showed an increase of 60,794 tons over the total for 1928, and is the largest total recorded for this country since 1921. The 1929 figures comprise 30 motorships, of 134,673 tons, including the "Chichibu Maru," of 16,920 tons, and the "Tatsuta Maru," of 16,780 tons, and seven others exceeding 6000 tons each. The motorship tonnage accounts for nearly 82 per cent. of the total output for the year. Two vessels of 15,942 tons, were launched for carrying oil in bulk.

United States.—The output for the year 1929, namely, 126,063 tons, was 34,706 tons higher than that for 1928, but was still lower than the average recorded for some years prior to 1928. Of the tonnage launched, 11 steamers of 44,192 tons, 25 motorships of 32,680 tons and 13 barges of 11,742 tons, were built on the Atlantic Coast; 3 steamers of 23,739 tons and 1 motorship of 1692 tons on the Great Lakes, and 10 vessels of 12,018 tons on the Pacific Coast. The largest vessel launched during 1929 was the "Pennsylvania," a turbo-electric vessel of 20,526 tons, built at Newport News. Six other vessels of between 7500 and 9000 tons were launched. Six turbine steamers of 42,025 tons were launched in this country during 1929, including the above-mentioned "Pennsylvania" and two other vessels of 11,000 tons, in which electric drive is likewise employed. Internal combustion engine tonnage launched amounted to 36,452 tons. Of oil tankers of 1000 tons and upwards, three of 12,303 tons were launched, all being motorships, one, of 1815 tons, utilising electric drive. The totals include seven vessels of 14,986 tons, built on the Isherwood system of longitudinal framing.

Denmark.—The tonnage launched during 1929—111,496 tons—was 27,216 tons less than during 1928, but still largely exceeded the output recorded for this country in any earlier year. The total was again composed mainly of motorship tonnage—94,649 tons—which included 14 vessels ranging from 4000 tons to 6000 tons, one of 6866 tons, and the "Amerika," of 10,300 tons, the largest vessel launched during the year.

Sweden.—The output for 1929—107,246 tons—slightly exceeded that for 1928, which was the highest previously recorded in this country. Nearly 97·5 per cent. of the total was composed of motorships—25 of 104,490 tons—of which seven are of between 6000 and 9000 tons each. The tankers launched—all motorships—amounted to three, of 23,400 tons.

France.—The output for the year—81,607 tons—compares with 81,416 tons for 1928. The motorship tonnage launched, 62,928 tons, was nearly four times the steam tonnage, and included the motorships "Lafayette," of approximately 21,500 tons, and "Felix Roussel," of about 17,000 tons, and three vessels of between 8000 and 8300 tons each. Only two steamers exceeding 4000 tons were launched, viz., a turbine vessel of 4840 tons, and a tanker of 7455 tons. Three vessels, of 23,668 tons, are intended to carry oil in bulk, two of which, of 16,213 tons, are motorships.

Italy.—The total figures for this country—71,497 tons—were 12,857 tons higher than those for 1928, but, with the exception of that year and of 1923, are much lower than those for any post-war year. The totals for Italy comprised a steamer of 6349 tons, and a motorship of 1450 tons intended for carrying oil in bulk. The tonnage of the 20 motorships launched during the year amounted to 55,447 tons, equal to 77·5 per cent. of the total output.

Shipbuilding Abroad During the Year.

Dealing with the combined totals for the work in hand in the various countries abroad, an increase took place during 1929. At the beginning of the year the tonnage under construction amounted to 1,375,207 tons, while at the end of December the total was 1,550,626 tons, an increase of 175,419 tons. The Returns for the fourth quarter showed that at the end of 1929, the countries abroad having the largest amount of tonnage under construction were:—Germany, 253,256 tons; Holland, 231,934 tons; Japan, 183,570 tons; the United States, 179,062 tons, and France, 167,177 tons. The countries which showed the largest increases were:—The United States, 131,113 tons; Japan, 64,990 tons, and Holland, 49,705 tons, while a considerable decrease took place in Germany, 129,166 tons. In Italy there was a decrease of 15,397 tons. In view of the high level reached by the tonnage now under construction abroad and of the fact that the tonnage recently commenced is much higher than usual, it would appear that the shipbuilding industry abroad, taking it as a whole, is in a more favourable position than has been the case for the last few years.

Summary of World's Output.

The total output during 1929 reached 2,793,210 tons. These figures represent an increase of 93,971 tons as compared with 1928. The output in Great Britain and Ireland represented 54·5 per cent. of the World's output during 1929, as compared with 53·6 per cent. for both 1928 and 1927.

Some interesting facts may be gathered from this summary as regards the special types of vessels and machinery included in the output of the year under review. The total launches comprised 27 vessels, of 174,000 tons, to be fitted with steam turbines, and 25 vessels, of 128,000 tons, having a combination of steam reciprocating engines and turbines. During 1929, vessels totalling 1,270,000 tons in which internal combustion engines are being fitted were launched. This tonnage compares with 1,183,000 tons launched in 1928. The present total is equal to 84·4 per cent. of the world's output of steam tonnage, as compared with about 62·8 per cent. in 1927, 29½ per cent. in 1924, and 7¾ per cent. in 1921. It should also be stated that the tonnage of motorships being built in the World at the end of 1929 was actually 387,451 tons larger than the steam tonnage under construction. Of the total steam tonnage — 1,504,000 tons—launched in the World, some 410,000 tons refer to steamers fitted for burning oil fuel under the boilers, so that the tonnage depending exclusively, upon coal for propulsion is only 39 per cent. of the World output for 1929. The tankers launched during 1929 amounted to 49 vessels of 324,870 tons, as compared with 646,851 tons in 1928. Of the 49 vessels, 31, of 213,783 tons, are motorships. During 1929 there were launched 33 vessels—of 1000 tons and upwards—of about 228,000 tons, built on the Isherwood system of longitudinal framing. It may be stated that during the year 63 whalers were launched, 35 in Great Britain and 28 in Norway.

It will be of interest to compare the total of the World Merchant Fleets in 1914 with the latest available figures. Disregarding sailing vessels and all wood vessels, in view of their comparatively small importance in international trade, the gross tonnage of seagoing steel and iron steamers and motorships amounted in June, 1914, to 42,514,000 tons, while at June, 1929, the figures reached 62,896,000 tons, an increase of 20,382,000 tons.

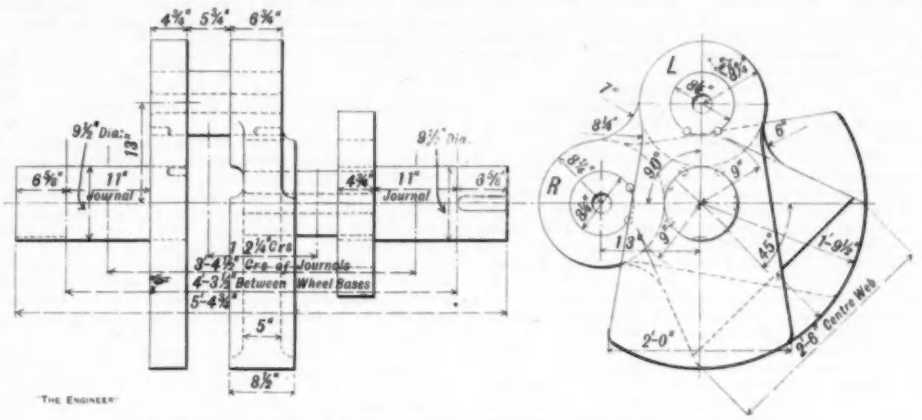
A remarkable change has taken place in the total tonnage of some types of vessels included in the above figures. For instance, the tankers which in 1914 totalled 1,479,000 tons now amount to 7,071,000 tons, and motorships, which in 1914 only reached 234,000 tons, now amount to 6,628,000 tons—including auxiliaries.

A great change has also taken place in the relative use of coal and oil fuel for boilers. In 1914 the gross tonnage of the steamers fitted for oil fuel was 1,310,000 tons, whilst the 1929 figures show 19,421,000 tons.

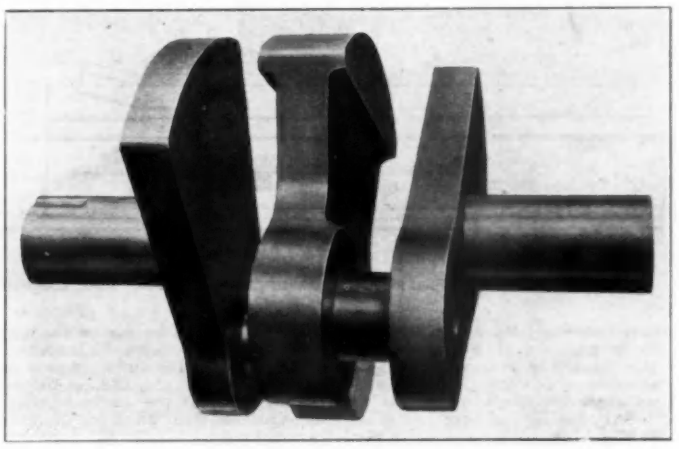
The Dominion Water Power and Reclamation Service of the Department of the Interior of Canada has issued its Annual Review of Hydro-electric and Water Power Developments in Canada during 1929. The statement shows that the activity which has been so evident in recent years has been fully maintained, and the number of water power schemes under construction and projected indicates that the high rate of increase in developed power will continue for some years to come. The total amount of new installations brought into operation during 1929 amounted to 378,400 H.P., bringing the total installation for the whole Dominion to 5,727,600 H.P. Undertakings now under active construction will, according to the programme proposed, add more than 1,600,000 H.P. during the next three years.

Built-up Locomotive Crank Axle.

In the brief description which we gave in our issue of January 3rd of Mr. Gresley's new 450 lb. locomotive "No. 10,000," we mentioned the peculiar form of built-up crank axle employed for the inside cylinders. The problem was to find room for two journals, each 11in. long, and it could not be satisfied by the usual design. We are now able to give a drawing of the axle designed by Mr. Gresley and a reproduction of a photograph. It will be observed that the central web is a spectacle plate with two holes at 90 deg. to each other, and a backward extension which forms a balance weight. The outside webs are also extended backward for the same purpose. The illustrations leave nothing more to be said, as they are completely self-explanatory.



ARRANGEMENT OF CRANK AXLE OF L.N.E.R. LOCOMOTIVE NO. 10,000



GENERAL VIEW OF THE CRANK AXLE

A SOUTH AFRICAN MINERAL RAILWAY.

With the completion of the railway to Postmasburg and the opening up of the enormous deposits of manganese ore, which lie some 8½ miles north of Postmasburg, it is expected that the Kamfersdam–Wintersrush–Koopmansfontein line will take on a new lease of life, and form part of what will soon become one of the best paying branch lines in the Union. The country through which the line passes is level and a gradient of 1 in 100 has been adopted so that the very heavy mineral traffic may be handled without difficulty. Five intermediate sidings and crossing loops are being provided to develop the farming industry, in addition to a station at Silverstreams, which will serve a large area of country, including the villages of Danielskull and Papikuil. The line will be 65¼ miles in length and is being built to main line standard, with 80 lb. rails and 2112 steel sleepers to the mile, and in a little over six months from now it is hoped that the line will be ready to take the manganese to the coast. In conjunction with this work, the section from Kamfersdam to Koopmansfontein is being relaid with 80 lb. material, and advantage will also be taken to replace the low-level bridge over the Vaal with a high-level bridge which will consist of six through spans of 100ft. each, carried on concrete abutments and piers taken down to rock. Flood openings, each of 30ft. span, are being built a short distance from either end of the bridge. The port of shipment is to be Durban. The British Swiss International Corporation, Ltd., has provided the money for the entire construction of the railway, which money is to be repaid by Government ten years after the date on which the railway is opened for public traffic, the Railway Administration paying interest at the rate of 4½ per cent. to the company in the interim. Any shortfall in the tonnage mentioned is to be made good by the company paying to the Administration a sum of 2s. per ton on such shortfall. British Swiss International Corporation, Ltd., has formed a subsidiary company, the Manganese Corporation (1929), Ltd., to exploit the manganese deposits, with a capital of £1,000,000. Actual mining was commenced in May of last year, and at the present time these are employed on the deposits thirty white men and over 400 natives.

Railway and Road Matters.

THE unusual incident of an engine losing one of its driving wheels occurred at Olton, near Birmingham, on the Great Western Railway last Saturday. The train was the 1.5 p.m. express from Reading to Birkenhead, with an engine of the 4–6–0 type, and the failure was that of the left-hand leading coupled wheel.

THE poll on the proposed Parliamentary Bill, promoted jointly by the London and North-Eastern Railway Company and the Hull Corporation, for the abolition of the railway level crossings in the city revealed widespread opposition, and the figures announced at the close of the poll were—against the scheme, 32,319; for the scheme, 2854.

FIFTEEN years ago the first of the Staff Suggestion Schemes was established by the Great Western Railway. The company has received over 30,000 suggestions during the last ten years, and they now average 4000 a year. The other companies have since followed suit and nearly 50,000 suggestions have been received by the railways since grouping became operative in 1923.

THE question of increased facilities for passengers on the Ilford line has long been a sore point with travellers on that section of the London and North-Eastern Railway, so much so that in the 1924 General Election the three parliamentary candidates vied with each other as to who would do the most. As a result of a meeting on January 29th between the Minister of Transport and some of the directors and chief officers of the L. and N.E.R., the company undertook to consider the construction of a tube railway between Liverpool-street and Ilford.

THE Ministry of Transport railway statistics for October last show that, compared with October, 1928, there was an increase of 4·1 per cent. in the number of passenger journeys, but a decrease of 0·7 per cent. in the receipts therefrom. Passenger miles increased by 2·2 per cent. Owing to an increase of 10·7 per cent. in the tonnage of coal, the tonnage of freight generally rose by 9·1 per cent. Freight receipts advanced by 3·7 per cent.; the freight train miles by 3·5 per cent.; the average train load from 126¼ to 130¾ tons, and the net ton-miles per engine hour from 439 to 451.

AN extraordinary meeting of His Exalted Highness The Nizam's Guaranteed State Railway Company was held on January 20th to consider an offer of the Government of the State to acquire the railway as from April 1st next instead of on January 1st, 1934, which latter date is the earliest it could be acquired under the existing contracts. The motion was carried unanimously. Remarking that the company's agent in India is Mr. Lloyd Jones, and that he is an engineer by training and, incidentally, was mainly responsible for the bridge impact tests in India which preceded our own tests under the Ministry of Transport, the chairman of the meeting in question said that to Mr. Lloyd Jones' clear vision, striking personality and business ability, he readily attributed the success of the negotiations with the Government.

IT is officially announced that the Great Western Railway is about to install colour light signals—as in the London Bridge area of the Southern Railway—between Paddington and Southall, a distance of 9 miles. This decision is the more striking because, except for some signals installed in 1928 between Old Oak Common East and Ladbrook-grove on the up engine and carriage line, the Great Western has had no practical experience of light signals. The success of those provided in the Charing Cross–Cannon-street–London Bridge area of the Southern and those at Manchester, Victoria and Exchange, on the London, Midland and Scottish, has, however, been so pronounced that there can be no question of a trial by any other company. On both the other railways great economies in signal-boxes have been effected, and it will be interesting to see what happens on the Great Western.

ACCORDING to a table in the appendix to the report for the year ended March 31st, 1928, of the Indian Railway Board, 92·1 per cent. of the 9020 locomotives on Class I. railways are equipped with the vacuum brakes and 57·6 per cent. of the 225,388 wagons have the vacuum brake complete, and another 17·4 per cent. are piped for the brake. In this column of our issue of November 23rd, 1928, we quoted from the previous annual report of the Board that various factors had so improved the working of wagons on Indian railways that fewer wagons had become necessary. These improvements evidently have been maintained, as the report for 1927–28 shows that on the broad gauge railways the average wagon load increased from 12·9 to 13 tons, the wagon-miles per wagon-day from 33·1 to 34·8, and the net ton-miles per wagon-day from 292·7 to 311·2. The wagon-miles per shunting engine-hour rose from 543·2 to 580·1; the wagon-miles per engine-hour from 182·5 to 187·5; the net ton-miles per engine-hour from 1613·2 to 1665·2; the gross ton-miles per engine-hour from 3893·3 to 4042·2, and the gross ton-miles per train engine-hour from 7725·3 to 7969·5.

"TINY," the only complete broad-gauge engine in existence, is one of the most interesting relics in the G.W.R. Museum. Built in 1868, it was recently rescued from the Newton Abbot locomotive depôt where, with one of its flanged wheels removed and a pulley wheel substituted, it had for years done duty as a spare stationary engine working the pumps in the boiler-house. To-day "Tiny" occupies a prominent position on Newton Abbot Station, right in the middle of the last section of the G.W. main line to be converted from the broad to the narrow gauge, and stands as a relic of this almost forgotten era of British railways. The company has many other relics of by-gone days. Some of them are at Paddington, but those of the more bulky type are to be found at other big centres on the company's system. At Swindon there is a perfect model of the "North Star," which was the company's first locomotive, and was used on the occasion of the preliminary opening of the line between Paddington and Maidenhead on May 31st, 1838. It was reconstructed in 1925 with many of the original parts, one of which, a buffer stuffed with horsehair, had been doing duty as a piano stool at Bath. It was sent to America in 1927 as the stable companion of the "King George V." locomotive in connection with the Baltimore and Ohio centenary.

Notes and Memoranda.

THE Department of Telephones in Iceland has decided to modernise its telephone system, and will adopt the Swedish L. M. Ericsson automatic system.

ACCORDING to some remarks made recently by Mr. W. M. Beckett to the Society of Engineers, if a scheme could be evolved whereby no omnibus was allowed to come within a radius of a mile of the Bank, and all passengers were conveyed over that mile in underground or overhead electric trains or moving platforms, it would go a long way to solving the traffic problem of the City.

SALES of incandescent lamps in the United States during 1929 were approximately 340,000,000 large and 292,000,000 small lamps. This is an increase of 18,000,000, or a little over 5½ per cent. in the large sizes compared with the previous year, and an increase of 37,000,000, or 14½ per cent., in the small sizes. These sales exceed all previous figures. On March 1st, 1929, 50-W and 60-W standard lamps of the 115-V group were reduced in list price from 22 to 20 cents, so that the 20-cent price now covers all the generally used lamps up to and including the 60-W size. The trend of prices has been downward for a number of years. The current prices are less than half the pre-war figure.

A COMPETITIVE examination for three or more appointments as Engineer and Ship Surveyor under the Board of Trade will be held in London on April 29th, 1930. The limits of age are from 25–40 years; the salary is from £300 to £500, plus bonus, which is at present £123 on the salary of £300. Candidates must possess either an Extra First-class (Board of Trade) Certificate of Competency as engineer, or a First-class (Board of Trade) Certificate of Competency as engineer, together with a B.Sc. (Engineering), or other equivalent voucher of scholarship. Applications are to be made not later than March 14th on the special forms, obtainable from the Senior Staff Officer, Establishment Department (Mercantile Marine Branch), Board of Trade, Great George-street, London, S.W. 1.

NEW principles to be applied to the search for oil in Australia and its territories have, says the *Chemical Trade Journal*, been approved by the Cabinet. A small staff of specialists will be maintained by the Commonwealth Government. The system of granting £1 for £1 subsidies for deep drilling operations will be discontinued, as it has been found to lead in some cases to premature deep drilling of unsuitable areas, and to the neglect of thorough and adequate preliminary geological survey in most instances. In approved cases, to enable persons and companies to carry out detailed geological surveys in areas considered reasonably likely to be petroliferous, assistance will be granted. In cases where geological survey is alone inadequate to determine the nature of the structures, the Minister may approve of the granting of subsidy for scout drilling by core-making methods, with or without pit sinking.

SWEDISH engineers have, during the past year, done much prospecting work in practically all parts of the globe by means of the method of electrical prospecting invented by the two Swedish engineers, Hans Lundberg and Karl Sundberg. Through this method, large and valuable ore fields were discovered in 1924 in Swedish Lapland. Since then the Electric Ore Prospecting Company—Aktiebolaget Electrisk Malmletning—has been called upon to investigate deposits all over the world, and during later years successfully applied its method also for oil prospecting work. Important finds have, it is said, been made in Newfoundland, where zinc and lead deposits have been discovered, as well as oil finds in Texas and big tin deposits in the East Indies. During the past year between thirty and forty Swedish engineers with prospecting crews have been working in Greenland, Finland, Germany, Roumania, Australia, the East Indies, Newfoundland, Texas, California, Cyprus and other places.

THE *Electrical World* in its review of progress during 1929 of electricity supply in the United States of America, gives the following particulars:—The number of kWh generated, including the output of railway power stations, increased by 12 per cent. to 94,337,000,000, of which 36·4 per cent. was produced by hydro-electric plants. The gross revenue was increased by about 8 per cent. to some £35,000,000. Operating expenses, excluding capital charges and taxes, amounted to 45 per cent. of the revenue. The output per head was 815 kWh and the corresponding revenue £3 12s. 3d. After deducting losses in distribution and inter-company sales, 77½ million kWh was sold to consumers in the approximate ratios for lighting, power, and railways of 26·2, 65·1, and 8·7 respectively. The number of consumers amounted to more than 24 million, of which 80 per cent. were residential. It is estimated that 70 per cent. of the houses have electric services, and that no towns of more than 2500 inhabitants are without a supply. American manufacturers are said to be adding to the plant operated by electricity from public sources at the rate of 1,000,000 H.P. per annum.

ACCORDING to the *Welder*, a welded condenser of 27,000 square feet surface, serving a 30,000 kW turbine has recently been put into service at a South Carolina power station. Limited headroom under the turbine made it necessary to suspend the condenser from the turbine exhaust flange, which made lightness desirable, and also imposed some deviation from the usual cylindrical form of shell. The shell was built of ¼in. plate; the usual thickness of a cast iron shell for this size of condenser is 1¼in. or 1½in. Double V-butt joints are reinforced with 5in. by 5in. T-bars, inside and outside. The plates were cut and welded into sections in the factory, the sections assembled and weld jointed on the site, with some reinforcement bars to carry the atmospheric pressure stress. The sectional construction saved a good deal in transport as compared with that of a complete shell 15ft. wide requiring special rail vehicles and possibly special traffic arrangement. Another advantage claimed is that the plate construction permits of a novel arrangement of water-boxes and tube plates which relieves the tubes from expansion stresses, and, therefore, promises to prevent tube leakages. This could not have been done with a cast iron shell without expensive machining.

Miscellanea.

SIR ALFRED YARROW has been elected an honorary member of the Institution of Civil Engineers.

A LARGE deposit of copper ore is said to have been discovered about 90 miles north of Gwelo, Southern Rhodesia.

IT is proposed to hold a pageant and exhibition at Liverpool from September 14th to 21st next to commemorate the centenary of the opening of the Liverpool and Manchester Railway.

A MISSION has been sent to the Continent with the object of securing for the Civil Research Committee which is inquiring into the iron and steel industry reliable data on the cost of labour in the continental industry.

IT is claimed that a steel truss recently put in place in a mausoleum in California is the heaviest truss with only welded joints so far made. It consists of three pieces, 36ft., 60ft. and 90ft. long by 17ft. deep, and its design calls for loads on the welds of 14,000 lb. per linear inch.

THE Canadian Department of National Defence has ordered sixteen light aircraft for use in connection with the training in the Royal Canadian Air Force, at a cost of 85,000 dollars. Fourteen of these machines will be "Avro Avians," built by the Ottawa Car Manufacturing Company, while the remaining two will be "Tomtits," ordered from the H. G. Hawker Engineering Company, Ltd., of Kingston-on-Thames.

AT a special general meeting of the Royal Institute of British Architects, on February 3rd, Mr. Percy Scott Worthington, M.A. (Oxon), Litt.D., F.S.A., F.R.I.B.A., was elected by the members, and his name will be submitted to his Majesty the King as a fit recipient of the Royal Gold Medal for Architecture for the year 1930. The Medal was presented last year to Monsieur V. A. F. Laloux, Honorary Corresponding Member of the R.I.B.A.

CALIBRATION tests have just been completed at the new Italian National Experimental Tank in Rome, which was described in THE ENGINEER of November 15th, 1929. It is reported to be the best-equipped and, in its harmonious dimensions, probably the finest tank of its kind in the world. It is built of reinforced concrete and has a length of 902ft., a breadth of 41ft., a depth of 20½ft., and a capacity of 18,000 metric tons of water. The main carriage, designed for a maximum speed of 12 m. a second, is adapted for testing hydroplane models as well as ship hulls and propellers.

IT is reported that Tokio is to have an opening bridge, giving direct communication between two populous districts, at present directly accessible only by three ferries maintained by the city. The bridge will connect two areas right at the mouth of the river, there about as broad as the Thames at Westminster, and will have a central drawbridge admitting the seagoing craft that usually use the river as far as the next bridge half a mile up. These are small coasting steamers of a few hundred tons, and rakish-looking sailing craft that remind one that the true sailor is not yet extinct. The ferry service costs the ratepayer about Yen 140,000 yearly, and the passengers carried total some eight millions, in addition to two million vehicles. The new bridge will cost Yen 3,500,000. It will be 810ft. long and 48ft. wide, and will be finished in 1932.

A FLOATING dock, constructed by the Furness Shipbuilding Company, Ltd., of Haverton Hill, has been launched at Leopoldville, the principal town on the Belgian Congo. The dock is the finest example of up-to-date marine engineering equipment in tropical Africa. It is fitted with the most modern applicances. The length is 60 m., and the width 18·80 m., and it is capable of lifting ships of 600 tons. After the work of construction and erection was completed, the dock had to be dismantled, packed, and all the material for the structure, weighing over 425 tons, transported to the Belgian Congo port of Matadi, and thence by railway to Leopoldville. The work of erecting the dock was done by natives. The Governor and all the principal officials and residents of Leopoldville assembled to witness the launch of the new dock, which is designed to take charge of the repair of the Huileries fleet of river steamers in the Congo.

A FEW days ago members of the Birmingham Junior Chamber of Commerce were addressed by Mr. E. J. Jennings, secretary and commercial manager of the Birmingham Electric Supply Department, who discussed the city's electricity supply and the Central England scheme. The history of electricity in Birmingham, he said, went back to 1882, when efforts were made to supply electricity to a few public buildings from a small plant in Paradise-street. That was not very successful, but in 1889 a company was formed to supply electricity for public services. Work began in 1890, and in 1896 a second generating station was opened. Then the Corporation took over the supply of electricity, and the growth of the undertaking was startling. The city now had power stations at Summer-lane, two at Nechells and at Hams Hall. At Dale End they started with 1700 kW, but now they had 250,000 kW, and there had been a growth equal to three and a-half times in the size of the undertaking in ten years.

THE Chilian Senate has now approved the new fifty-year concession permitting the Chili Telephone Company, associated with the International Telephone and Telegraph Corporation, to penetrate throughout the country with its own lines and to connect the system with all other national operating systems. It was in 1928 that the Chili Telephone Company became associated with the International system, and has since been operating the largest telephone system in Chili, though the lines have not yet reached all parts of the country. International service with the neighbouring republics of Argentina and Uruguay has been established and a definite prospect is now opened for an extension to other territories served by the International system *vid* the Buenos Aires-Madrid radio link of the Compañía International de Radio (Chili). This new concession brings Chili within speaking distance of Europe, and shortly a similar connection will be effected with the United States. Work has already been started on a new wireless telephone station in Chili which will later provide means of direct communication between the Chili Telephone Company subscribers and various countries of the world.

WAGON MARSHALLING YARD AT LA DÉLIVRANCE, LILLE—CHEMIN DE FER DU NORD

MM. DELOISON AND DEYON, LILLE, ENGINEERS

(*For description see page* 158).

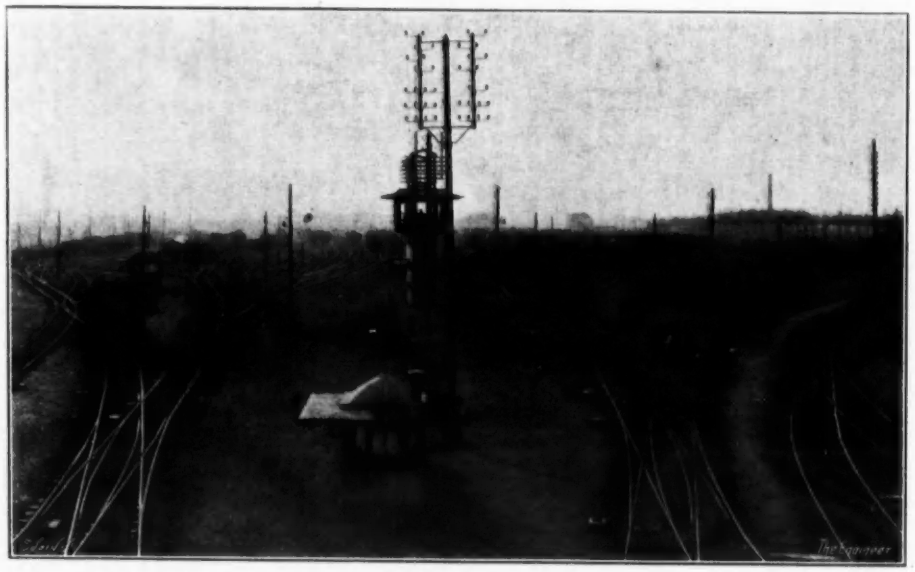


FIG. 3—GENERAL VIEW OF LAY-OUT

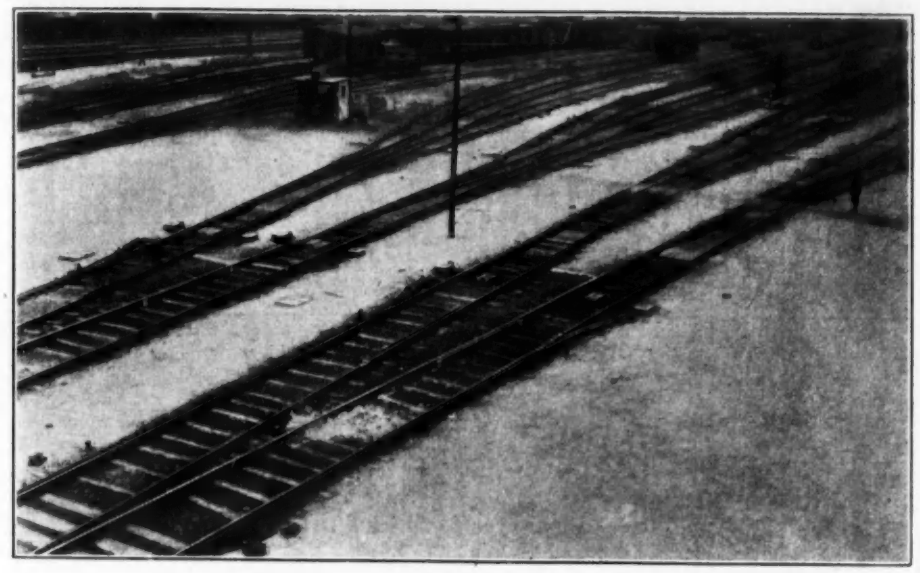


FIG. 4—SECOND AND THIRD MOVE OF LAY-OUT

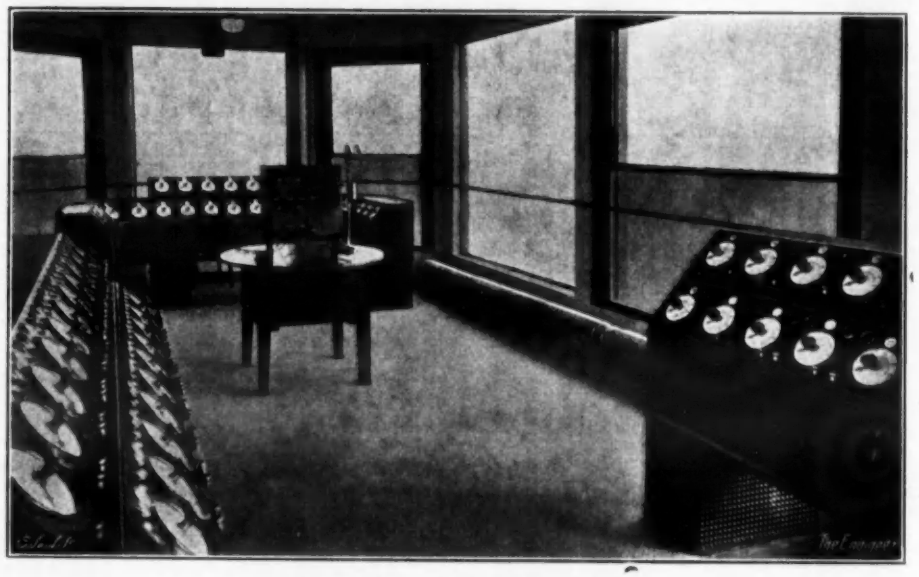


FIG. 5—INTERIOR OF CONTROL CABIN

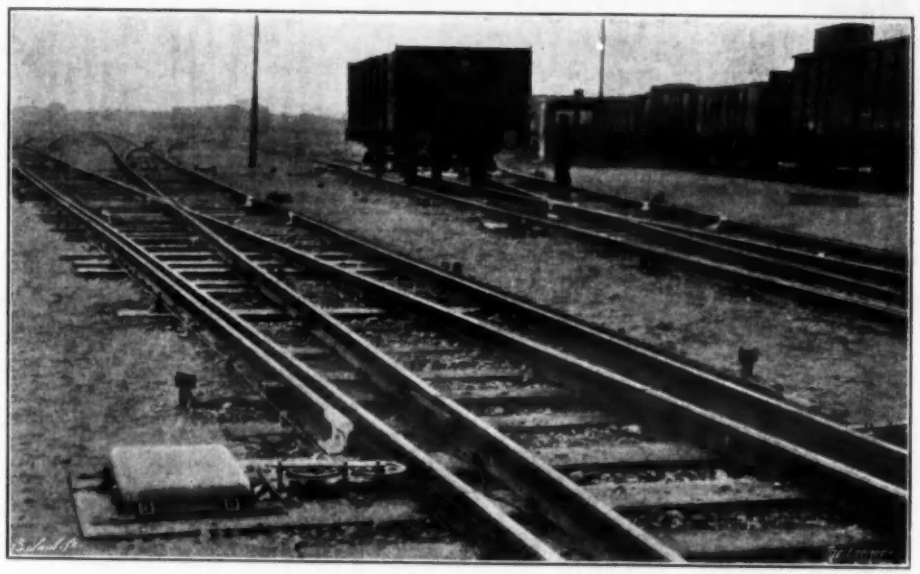


FIG. 6—RETARDING APPARATUS AND MOTOR

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NOTICES TO READERS.

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DEATH.

ON February 1st, at "Park Mount," Belper, ALLAN E. SMEDLEY, Managing Director of Smedley Bros., Ltd., of Belper, in his 69th year.

THE ENGINEER.

FEBRUARY 7, 1930.

The Ways of Our Competitors.

LAST week we were a guest at an exceptionally interesting dinner party. It was given by the British Chemical Plant Manufacturers' Association. With all the functions of that Association we are not familiar, but we know that it meets now and then to dine and discuss some matter of interest to its members. The Press is not there, and there is no published record of the proceedings. It is in a sense a private party. Last week the debate turned upon the use of foreign chemical plant in British works, and, whilst we must not review it as a whole, we trust that we shall be guilty of no discourtesy if we offer a few reflections on the subject regarded in a general light, and upon one or two points that were made by speakers. What is true of chemical plant is true of other kinds of plant in a greater or less degree. If good reasons could be advanced for the purchase of foreign chemical plant then, in many cases, the same reasons would hold for machine tools, turbines, locomotives, cranes and other products of the engineering industry.

Let us say at once that we did not hear a single good argument why plant should be bought abroad. Whether that was because the major part of the diners were manufacturers themselves or whether a natural diffidence restrained them we cannot say. We believe that one of the arguments is that foreign plant is cheaper, but the question of price only arose in another connection, to which we shall refer later. To our minds the most interesting suggestion made during the evening was that foreign buying is the outcome of a psychological reaction. There is, no doubt, a deal of truth in that contention, not only with regard to chemical but to all sorts of plant, and it is one to which our salesman should pay particular attention. The Germans, to take particular competitors, have created a "superiority atmosphere." They have nurtured the belief that they are thorough, that they are exceptionally scientific, that they have a marvellous ability in the application of research. Thus, in the purchaser's eye, they start with an advantage when placed in competition with British manufacturers, who, owing to the perfectly absurd wave of inferiority complexes which is spreading through the country, are supposed to have none of these things. The poor British maker has often to beg for consideration when it is offered with both hands to his Teutonic competitor. Now, our German friends have very carefully cultivated that attitude, and it is not difficult to see the mechanism employed. Take up any German technical paper you please and you will find in it pages and pages devoted to descriptions and analyses which here would be dismissed in a column or two. The thoroughness is excessive and, often enough, the elaborate calculations are useless, being based on doubtful premises or carried to an absurd degree of putative accuracy. But this sort of thing impresses the British buyer, particularly if his knowledge of German is small. He assumes that all he sees is of real value and importance and at once credits the German with great attention to detail. He feels sure he must be right because he has so many arguments and has made so many calculations ! Furthermore, some of our continental competitors are far more astute publicists than we are. They bring out admirable descriptive pamphlets in the language of the nation they wish to approach. These pamphlets are as replete as the originals on which they are based, and they have the same air of perfect knowledge and perfect confidence. Not infrequently they carry the purchaser off his feet, and the order goes abroad. All this is very good business and it would be—it is—the greatest mistake to despise it. If this kind of publicity gains its end, as it does, little or nothing is achieved by saying that whilst the British products are just as good, if not better, there is less talk about them. If it pays to talk, to talk excessively, redundantly, pedantically, then we, also, shall have to take to talking. But we shall have to do it as well as the Germans do. The indifferent "talk" which disfigures so many of our catalogues is out of date. It has ceased to be effective with a better educated public. Where we used such hackneyed descriptions as "a massive bed-plate" the wily modern salesman, by an affectation of learning, explains the wise proportioning of the main casting. But although we may, by adopting his own tactics, overcome the psychological perversity in favour of the foreigner, the question of price will still remain. In that connection the position appears to be reversed, for British thoroughness sometimes puts us at a disadvantage. It is possible to make a thing too good, to do a job too well. Discretion is necessary. Nowadays no one wants a machine to last for ever. There are planing machines made by our ancestors which are a positive encumbrance to their present owners. They won't wear out ; their cost was written off ages ago ; they are still serviceable, and it seems a shame to break them up. So they go on standing in the way of something better. Again, in many machines and appliances there are parts that, whatever one may do with them, wear out and must be replaced frequently. The less work that can be put into such parts the better. It is false economy to spend more than just sufficient upon them. In these directions our competitors have developed considerable skill. They skimp intelligently where thoroughness is unnecessary, and save cost thereby.

These two courses by which our rivals gain an advantage over us are foreign to our natures. We are not naturally given to prolix descriptions and discussions. Our taciturnity leads us to brevity. When we have said all that seems necessary we cannot understand why anyone should expect more. In fact, we do not know what to say ; for us the subject is exhausted. We cannot talk learnedly in half a column about a split pin. It is a split pin to us and nothing more. If we put on a fly-wheel we see no reason to say more than that it is heavy enough for its purpose ; a German would give all the calculations, hint at research, and discuss the section of the rim. It may be all foolishness, but it pays. But if we cannot pursue this semblance of thoroughness, neither have we learnt how to be discreetly un-thorough in our work. We endeavour to reach the best possible in every part, regardless of the fact that something less good would be equally serviceable and would be cheaper. We live up to our magnificent reputation and, at times, it betrays us. A wise discretion in thoroughness is more profitable.

The Housing of Workmen in Belgium.

BELGIUM being a densely populated, highly industrialised and by no means wealthy country, has its full share of difficulties with respect to the housing of its workmen. Slums of the worst kind exist in almost all centres of population, and

although the "Ligue contre les Taudis" and other social organisations keep the public conscience awake to the state of affairs, effective action is stultified by the absence of sufficient accommodation of a proper kind where the poorer classes may make their homes. The more enlightened employers of labour realise that decent homes for their workpeople lie at the base of that contentment and social stability without which industry cannot flourish. Individually, however, they are almost powerless to improve matters. In Belgium, as in other countries, colliery companies have found it necessary to provide houses for the miners, but such a solution is beyond the means of the ordinary employer. Nor is it entirely satisfactory. The men do not like the standardised "corons" in which they are compelled to live, nor can they be expected to accept with enthusiasm conditions which involve the loss of their homes if they lose or change their employment. Moreover, quite apart from these considerations, the system is applicable to so small a proportion of the artisan and labouring classes that even its widest practicable extension would do little to solve the housing problem as a whole. The wholesale construction of workmen's dwellings by State-aided or municipal effort, which would appeal to a socialistically-minded community, has met with little favour in Belgium, where the people are, on the whole, individualists. Yet some solution had to be found, and the true sense of social responsibility, which individualists so often demonstrate, has once again been shown in a scheme recently put into operation.

The underlying idea is that the workmen shall own their homes, and that each shall have, not a "standardised" house built by contract to suit the "average family," but an individual dwelling situated as far as practicable where the owner wishes to live, and constructed, also within the limits of practicability, to suit his particular needs. This means, in short, that every workman shall be enabled to build his own house—an ideal solution if the financial problem can be settled. The employers in the Tournai district, who, it will be remembered, originated the payment of "family allowances" described in our issue of September 6th last, and now regularised by law as an integral part of the Belgian wage system, were the prime movers in the attempt to cope with the housing difficulty. Their scheme was based on the principles mentioned above, and met the financial question by a method of co-operation among employers somewhat similar to that devised to make the system of "family allowances" workable. By this method all employers in the area contribute to a central fund in proportion to their wages bill, their contributions being assessed every three months on the basis of the wages paid during that period. This fund serves to provide grants to assist workmen who are purchasing or constructing houses on the "easy payment" plan. All workmen in the service of the affiliated employers are eligible for such grants, so that a man may change his employer without prejudice to his right to the grant. The amount of the grant varies according to the circumstances of the workman. For a married man without children it is equal to one-tenth of his monthly payments in respect of a house. For men with greater family responsibilities and, therefore, with less margin for house-purchase, the grant is increased. A man having four children to keep is given half of the sum he has to find monthly, while for a man with seven or more children no less than 80 per cent. of his monthly payments are given him from the fund. The scheme is being fathered by the Chamber of Commerce of Tournai, which has prepared a Bill to give it legal status. The Bill provides, among other things, for the establishment of a system of building inspection to protect the workmen and to prevent the money being wasted. Besides the donations towards monthly payments, the Administration of the fund is empowered to advance, to necessitous families, the initial deposit demanded by the building societies before construction is commenced.

The scheme we have outlined is not only interesting as a practical attempt to provide a solution of the housing problem, but it deserves attention by reason of the principles involved. There is recognition of the fact that, as industry is the only source of wealth, it is industry in the long run which has to bear all the "operating and maintenance charges" of a country. If, then, houses to enable the workers to live have to be provided at the expense of industry, it is surely better that industry should bear its burden directly than that money should be taken from it by taxation and the houses built with what remains after Government ineptitude and official mismanagement have had their toll. Money raised in the manner we have indicated and spent only under the supervision of men who are interested in its being wisely used, and who are competent to see that this is done, will go much farther than money which passes through the coffers of the State. Applied, moreover, as a subsidy to individual thrift it is doubly beneficial. Its graduated scale is intended to make it possible for any workman, no matter how great his family expenses may be in proportion to his wages, to obtain within a reasonable period a home of his own. He is under no obligation to remain in the same employment, for his grant will be continued as long as he works for any firm affiliated to the group. The pooling of their responsibility also makes the scheme fair as between different employers. Their contributions to the fund being proportional only to their wages bills, their charges are not increased however heavy may be the grants to their particular workmen. Thus it is a matter of indifference to them whether an employee has a right to much or little from the fund, for their payments will be unaffected. The workman, too, is safeguarded, for a man with a long family and, therefore, entitled to considerable grants, is in no way prejudiced in obtaining employment. The success which has attended the "family allowances" system, which is organised on very similar lines, encourages confidence in this scheme for dealing with the housing problem. The employers of Tournai are to be congratulated on this second example of their initiative in ameliorating the conditions of their workmen, which may possibly have as wide a repercussion on Belgian industry as their introduction of the system of family allowances.

The World Engineering Congress in Japan.

(By Our Special Representative.)

No. VIII.*

TOKIO, December 31st.

ABSTRACTS OF PAPERS *(continued)*.

Household Refrigeration in the United States, by J. B. Churchill, engineer of the Icemaster Company, New York, deals with a comparatively new but rapidly expanding department in the field of engineering—a subject of personal interest to all living in climates where for several months of the year torrid conditions prevail. In connection with this subject, it is of interest to note that Einstein, of relativity fame, is credited with having filed an application for a patent for an electric refrigerator which, it is claimed, will reduce costs to about one-quarter. It appears that Dr. Einstein assisted a young Hungarian inventor, Dr. Szillard, who submitted the idea, and the two have collaborated.

The Application of Engineering Methods to Finance, by C. H. Douglas, M.I. Mech. E., contains suggestions it might be well for some of our statesmen and dole experts to study. Mr. Douglas asks what is the true objective of industrial activity. A common idea, undoubtedly, is that it is to provide employment. He postulates three objectives:—(1) To provide employment; (2) goods and services; (3) money. The problem is dealt with by means of a sum in mathematics, and it is demonstrated that the true objective of industrial activity is the supply of goods and services.

Among several papers on oil shale and shale oil that entitled *The Origin and Constitution of Oil Shale, with a Practical Application*, by E. H. Cunningham Craig, B.A., F.R.S.E., F.G.S., M. Inst. P.T., late of H.M. Geological Survey of Scotland, must not be overlooked. The author, in particular, examines the nature of "Kerogen," about the origin of which geological opinion differs. Mr. Craig's contention is that the origin of oil shale is fully explained by the migration, inspissation, and adsorption of petroleum, and that kerogen is the result of surface tension, a colloidal compound of organic and inorganic materials. Summing up his considered opinion, the author says: "The writer from the study of many shale fields and oil shales, both in the field and laboratory, submits that no other theory will explain all the phenomena of all oil shale fields, that no other theory will account for the packing of so much oil-forming material into beds containing from 50 to more than 70 per cent. of inorganic material, or for the observed mutual relations of petroleum, oil shale, and coal. Such objections as have been raised to this theory are frequently mutually contradictory or are founded on insufficient microscopic observation or from a partial study of the subject confined possibly to only a single field, rather than from a world-wide consideration of the subject. It may perhaps be necessary to repeat that torbanites, often erroneously classed as rich oil shales, do not come within this inquiry, being an entirely different and separate phenomenon."

And in conclusion: "If shale oil is to be enabled to compete with free petroleum, it must be of good quality, approximating more nearly to its rival. It must also be capable of being refined cheaply and easily into saleable products, without the excessive loss in refining which is such a conspicuous item in shale oil refinery practice at present. Furthermore, the process of producing the crude shale oil must be inexpensive, the plant must be cheap to erect and to operate, must be compact rather than unwieldy, and must work almost automatically. The making of ammonium sulphate may be neglected if petrol can be produced in sufficient quantity. It is the writer's belief that along these or similar lines rather than by persisting with 'destructive distillation,' that the future prosperity of the oil shale industry is to be sought."

Colonel P. H. Johnson, C.B.E., D.S.O., deals with the subject of *Roadless Transport* in a way which convinces the reader that the British people are negligent in taking advantage of their great opportunities. The treatment of the subject opens up in a vivid way the possibilities of development in all lands if the advantages given by means of mechanical transport could only be brought home to the most backward of peoples, including ourselves. Colonel Johnson makes clear the fact that development in the remoter places of the earth will never take place if it has to depend upon railways and made roads. The cost is too great; the economic justification too little. The solution lies in heavy "endless track" vehicles, which can go almost anywhere, at no expense to the native. This type is adapted to countries without roads; that is, to the greater part of the countries of the earth and their peoples, who know nothing of roads and less of railways. When the railway was first opened in Japan the glass windows had to be smeared with white paint in order to prevent people from pushing their heads through a substance they knew nothing of; moreover, there was tremendous difficulty in getting the people out of the trains once they got in, for they would take a ticket from Tokio to Yokohama and stay in all day, running to and fro!

The point in this paper is that we should not wait for railways and roads in countries where economic conditions may not justify them for years to come, but use a type of vehicle that has already proved its value in lands where it is not nearly so badly needed.

Experiments in the production of artificial rain are carried on systematically in Czechoslovakia, as appears from a short paper prepared by the Ministry of Agriculture of that republic, which describes in detail the efforts made in readjusting the land for various agricultural purposes. The methods followed in improving the land were shown at the Exhibtion in Prague in 1927, while, as to producing rain, the report states that the experiments had "important results."

One becomes so accustomed to reading of hopeless, impracticable projects in Russia, engineered by the idealists in the saddle at Moscow, that it is refreshing to read of a scheme of the Soviets that seems eminently practical. This is the proposed irrigation of regions much subject to drought across the Volga and in the Southern Caucasus and Southern Ukraine—State enterprises to be undertaken at an estimated expenditure of between 150 and 200 million roubles. The paper expounding this scheme is by Engineer A. Chaplygin, who, in effective English, explains the plan to bring water to some 960,000 square kilometres of arable lands in the regions mentioned. In these districts, drought appears to be the chief enemy of the farming population, and huge sums have been spent during the past thirty-five years on famine relief, providing the people with food, seed and cattle. The expenditure thus incurred very greatly exceeds the sum it is now proposed to spend, which would remove the fear of famine and ensure a regular water supply.

Mr. Chaplygin presents his subject clearly and convincingly, and it is interesting to note that in the Volga project, when irrigation is a fact, the land will be divided up so that 50 per cent. of it will be assigned to large State and "collective" farms, and the balance will be allotted to the peasant families which are now working the whole area, but with uncertain profit. The peasants will thus lose considerable land, but will be benefited by the assurance of regular crops. The size of the individual farms is to be from 14½ to 21 hectares, of the collective farms, 440 hectares, and of the State forms, 1000 hectares. The cost of the particular plant under consideration, including pumping station, reservoir, and irrigation channels, is apportioned as follows:—Main channel with pumping plant and electric transmission lines, 47,600,000 roubles; storage reservoir, 18,100,000 roubles; irrigation channels and ditches, 41,500,000 roubles; surveying and design, 3,700,000 roubles. The capacity of all pumping stations is estimated at 87,000 kW, requiring a power plant of 102,000 kW. The proposed capacity of the plant is 132,000 kW, divided into two units of 66,000 kW each.

THE FOREIGNER'S FIRST HOME IN JAPAN.

Travellers to Japan from China invariably touch first at Nagasaki, and are probably on one of the

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twin express steamers (built at Dumbarton) which the Nippon Yusen Kaisha run between Nagasaki and Shanghai, the 465 miles taking 27 hours, and the to and fro service being maintained with the regularity of clockwork. The approach to Nagasaki harbour gives the stranger a magnificent introduction to Japan. No flat lands; no broad vistas, but precipitous lumps of islands springing right out of the sea, dotted with eccentrically shaped fir trees. The ship as it approaches seems to be running head-on into these tiny but precipitous islands, and turns and twists amidst a marine fairyland until it glides smoothly into the beautiful harbour.

In imagination, one sees the early foreign navigators—the Portuguese, Dutch and English—searching out this port, hidden behind its barricades of mountain islets. For four hundred years, Nagasaki, or Nangasaque, as recorded in the old books, was the one port of Japan for aliens, they not being allowed to touch other parts of the sacred land. Here, they carried on trade, their small ships laden with goods from China and Java and carrying goods away, some of which, in the form of pictures and curios, must still exist in the homes of the rich throughout the East.

Nagasaki would excite the keenest interest among the W. E. C. delegates as the most picturesque and the best-built of the port cities of Japan. Here, for a number of years, Dutch and English were keen rivals for Japan's trade, until the latter withdrew, not being prepared to accept the conditions imposed upon the Dutch, or, perhaps, finding the trade not so worth while. The Dutch, on first settling in Japan, lived at Hirado, a port further along the coast, but were moved to Nagasaki for purposes of policy, and settled on an islet which is now part of the mainland. In these circumscribed quarters they traded for two hundred years. Their representatives, periodically, had to visit the Shogun's capital to make obeisance and pay tribute, the journey to Yedo (Tokio) often taking two months, and being filled with adventure, which the travellers did not fail to record for the benefit of succeeding generations.

As to the nature of their island home, and the reason they were removed there, the W. E. C. booklet, dealing with Nagasaki, says: "Dejima [literally, Projecting Island], now a part of the city proper, was a reclaimed island made in 1635 by Nagasaki townsmen to accommodate the Portuguese who had been living scattered in the city. It remained the only foreign settlement. As a consequence of the Shimabara rebellion in 1658, when the Portuguese were expelled from the Empire, the Dutch residents were removed here from Hirado, a port in the adjoining fief, and here they lived in strict confinement for more than two centuries, from 1641 to 1858, and on this restricted bit of territory and under the strict vigilance of the Shogunate officials, they were allowed to live and trade with the Japanese. Although there are no remains of the Dutch houses, which had been a source of wonder and curiosity to the Japanese, Dejima is the most historic spot in the early foreign history of Japan, as the place where Western civilisation first impinged."

To-day, foreign ships tie up at Dejima pier.

Nagasaki is strikingly un-Japanese in some of its features, and there is ample evidence of the influence of the Dutch and other early foreign settlers, for though we are officially informed that they were "strictly confined," such was not the case. Shogunate authority was an intangible thing, and was often flouted by a people eight hundred miles away from the centre of things. The Dutch were probably good company. They were a valuable local asset as the only channel through which the Japanese people could obtain glimpses of "the wonders of the world abroad" and gain their first notions of Western science and medicine. A curious, alert-minded people like the Japanese would consult them on every occasion, as they consult the foreigner to-day, and they would use their services. How valuable these were would appear from the fact that it was death for a Japanese to leave his native land. This penalty was imposed when the country was closed to foreigners following the Shimabara rebellion, when thousands of Christian converts were massacred by order of the Shogun, and the Empire closed to foreign intercourse, to remain sealed for two hundred and fifty years.

During the first decades of the last century Nagasaki became the centre of the Empire's trade with Russia, and in the decade that saw the opening of the ports to foreign trade, 1859–68, reached the height of its pre-eminence, soon to give way before the rapid development of Yokohama and Kobe, both more conveniently situated in relation to the capital and centre of industry, Tokio and Osaka respectively. To-day, Nagasaki has lost its comparative importance, though it is the foremost shipbuilding centre of the Empire, and has a steadily growing trade and population. The owners of the great shipbuilding yards, the Mitsubishi Company, are also the owners of the local collieries, which are grouped together on three of the small islands. According to the W. E. C. guide, these mines are noted not only for producing the best Japanese coal, but as being the first Japanese mines to be worked by European methods. The coal is deemed indispensable for steamers where speed is a consideration, as well as for gas, coke, and chemical works.

The very first thing the normal camera-carrying tourist is inclined to do in a place like Nagasaki is to take a snapshot. Being a stranger and a man of the hard and practical West, his fancy is taken by the pisturesque little nesan with the family baby on her back and her head wrapped round in blue cloth—a perfect picture for the folks in Wigan. Out comes the camera, smiling negotiations with the nursemaid, with perhaps the passing of a scret commission—click, and the deed is done. Anon approaches one of Japan's incomparably dignified policemen—who is careful to arrive after the passing of the money—an unintelligible exchange of language, and our tourist finds himself under arrest. He has broken the law. He has taken a photograph in a fortified zone. He is subject to fine and imprisonment. If there are ladies in the party, the situation will be regarded as serious, for nothing will persuade the ladies that their husband and/or father is not going to be carefully cut up and eaten. The sequel to the adventure will depend entirely upon the behaviour of the lawbreaker. If he bows to the inevitable, and is polite and considerate and does not smile at the little policeman with his big sword, he will escape with a gentle admonition; if he is "obstreperous," and stands upon his dignity, the trouble may involve an appeal to the consul and develop into a situation that only a Bernard Shaw could make more complicated. The Fortified Zone law is a law, and despite what Dogberry says, it must be obeyed.

The Premier Port.

Ranking as one of the "six great cities" of the Empire, and now the premier port, Kobe is a striking tribute to the exertions of the early foreign pioneers, and in this respect may be placed with the ports of Shanghai, Hong Kong, and Singapore, which, almost within the memory of living men, have grown out of nothing, mere wastes of mud, sand, and rock into great centres of trade and civilisation. Such has been the character of Kobe's development, that it has completely overshadowed the city of Hiogo, the provincial capital, whose name is rarely seen on the map.

The original "foreign settlement" was a piece of the foreshore to the east of Hiogo, some 700 yards long and 250 broad. This land was parcelled out into numbered lots, and regular streets were laid out at right angles. As in Yokohama, the land was leased in perpetuity at a low rental per tsubo by the Government, and when in later years it acquired value, due entirely to the exertions of the foreign community, the Government sought to impose further taxes, ignoring the conditions under which the foreign leaseholders and renters held the land and property thereon. The dispute which ensued continued for years, the matter becoming a question of diplomatic and international importance, until Japan consented to submit the whole question to the judgment of The Hague Court. In due course, judgment was pronounced in favour of the foreign claim, but Japan refused to abide by the decision, and illegal exactions continued for many years, leaseholders and renters paying the increased rates under protest, but never paying voluntarily. The custom was to leave the safe open, or a till open, or place a sum of money on the counter, when the tax collector came and took what he wanted, rendering a formal official receipt for the money taken. This state of affairs continued right down to the earthquake. Some sort of settlement has since been reached, the leaseholders in Yokohama, for example, selling out to the Government, thus disposing once and for all of an awkward question, long the cause of much bad feeling between native and foreigner in Japan.

In course of time the settlement in Kobe became known as the "Model Settlement" in the Far East. Like Shanghai to-day, it was something of a republic in the old days of extra-territoriality, but with the revision of the Treaties and the rendition of the settlement to the local authorities, an advisory committee—of foreigners—was annually elected, and for some years the Japanese wisely left the "Settlement" alone, conscious perhaps that they themselves certainly could not govern it better—the generally disorderly and nondescript appearance of the adjoining town presenting no admirable spectacle of civic efficiency. To-day, the settlement is steadily losing its old appearance of neatness and orderliness, and the time will come when it will be undistinguishable from the surrounding milieu.

Kobe benefited enormously from the earthquake which reduced Yokohama, once the premier port, to temporary impotence. For a time it became the centre of the great silk trade, but this is now returning to Yokohama, so much more favourably situated as the port of export of this valuable commodity; for some years also it became the headquarters of foreign banks and firms, and many Japanese concerns moved here temporarily. Of this unexpected good fortune the port took full advantage, developed rapidly, and increased greatly in population, which now exceeds 700,000.

Besides a great shipping trade, with imports and exports aggregating nearly Yen 2,000,000,000 in value, the port has a growing shipbuilding industry being the headquarters of the Kawasaki Dockyard, builders for the Navy, the Mitsubishi Shipyard, which has a branch here and a floating dock. Several shipping companies also have their headquarters at this port, including the Kokusai Steamship Company, a concern which has recently insured its whole fleet of forty-seven ships, totalling 360,000 tons, with London underwriters, obtaining a much more favourable rate than that prevailing in the Japanese market. It is reported that other shipowners will follow this example. Kobe is also the headquarters of several British industries, including the Dunlop Rubber Company, the Lever Soap Works, subsequently taken over by the Japanese, the Tansan Mineral Water Company, and many industries now Japanese which had a British beginning, such as the Osaka Ironworks. The British, in fact, are closely associated with Kobe, having been from the beginning the strongest element in the foreign community, and being the largest and most important British colony in the Empire to-day.

These enterprises, however, while develpoing, are on a small scale compared with the leading Japanese enterprises of the port, including the spinning and weaving mills, steel works, match factories—the latter controlled by the Swedish trust—&c. And all of very modern creation and development. As recently as 1913, it was considered impossible to produce top in Japan; now all the national requirements are supplied by Japanese mills. This transformation is the story of modern Japan; everything was at one time "impossible"; to-day, everything is possible. And the foreigner has had a great deal to do with this change in the national temperament, for there is not an industrial enterprise in the Empire with which he is not directly concerned as creator or improver. Without foreign stimulus Japan would have made little advance.

A word about the wonderful suburban areas of Kobe. They reach a height of 3000ft. Few great centres of population are so fortunately situated. Between the old settlement and actual mountains, there is less than a mile of distance. The foreigner emerges from his house on the "Hill," and a few hundred yards' walk takes him right into pleasant upward glades, and soon he is able to see through an opening in the trees the city down below and the ships in the harbour. The first golf course in Japan was laid out in 1904 in these high altitudes, and here is the foreign summer colony, 3100ft. above sea level.

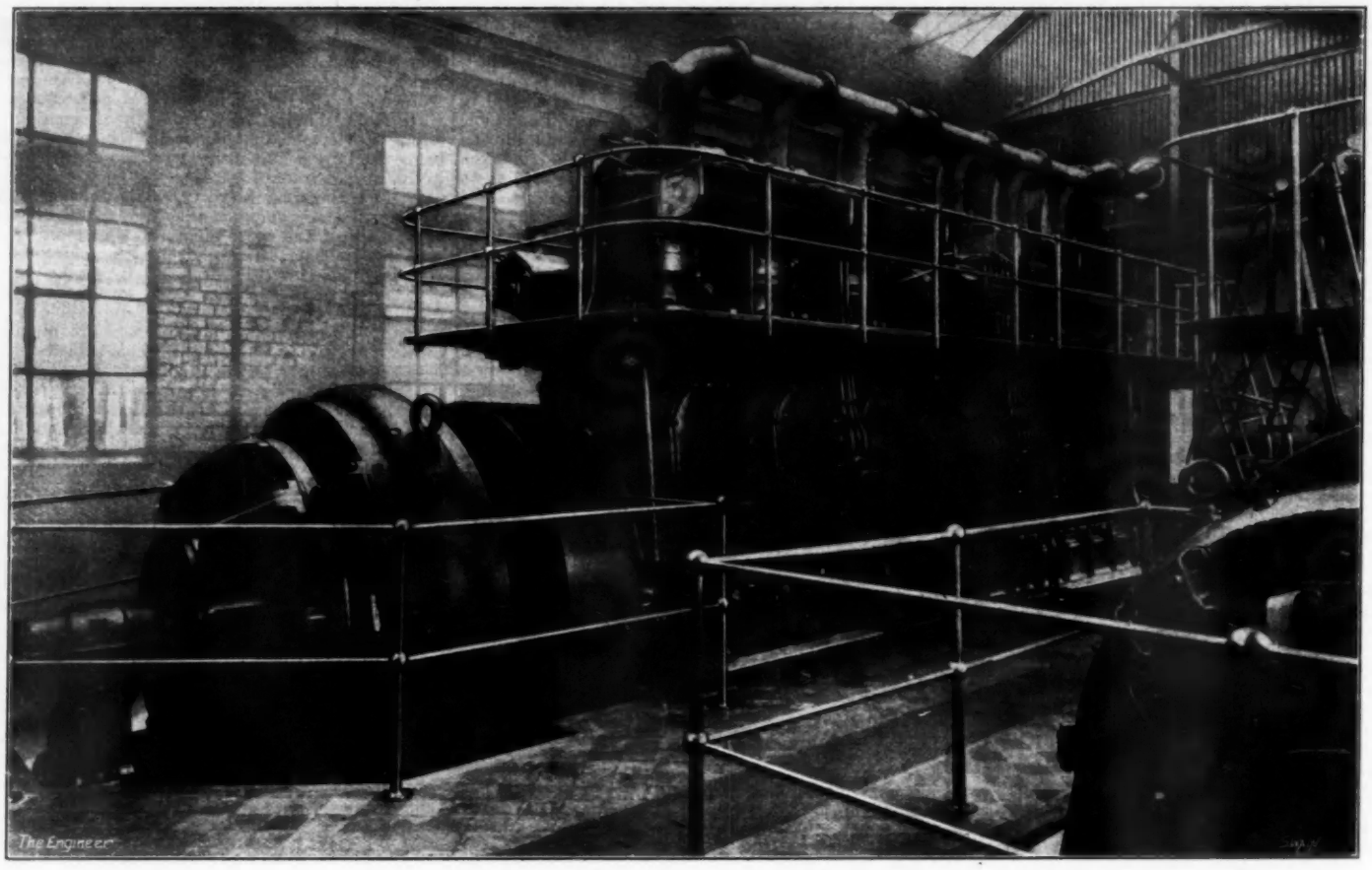
(To be continued.)

SIXTY YEARS AGO.

Elsewhere in this issue the reader will find a summary of a report issued by the Department of Scientific and Industrial Research, and from that report he will be able to gather, if he does not already possess it, some information concerning the very great and still increasing assistance which the State now gives to scientific investigation. There is to-day no branch of science, not even excepting astronomy and biology, and there is scarcely an industry which the State is not actively helping, either by direct investigation in its own laboratories by its own officers or by generous financial assistance to outside institutions and individual private workers qualified to undertake research work. Sometimes, as in the case of the cutlery industry, the assistance of the State is rejected or is treated with indifference. In almost every instance, however, the aid which it is anxious to render is fully appreciated, and is welcomed as a valuable and economical means of furthering the cause of science and technology. Sixty years ago the State, beyond supporting Greenwich Observatory, the British Museum, and the Science and Art establishment at South Kensington, assisted science to the extent of an annual grant of £1000 placed at the disposal of the Royal Society to cover the cost of chemicals and apparatus required by selected investigators. There were those who thought that the State's activities in this direction might with advantage be increased. Among them were the members of the Council of the British Association. On February 4th, 1870, a deputation representing the Association waited on Earl de Grey, Lord President of the Council, to urge their views on the Government. It would appear from the references made to the subject in our issue of a week later, that the deputation was not quite united in its opinions as to the precise direction in which the additional State assistance sought should be applied. Some held that it ought to take the form of increased facilities for scientific education. Others, including notably Professor (Sir George) Stokes, urged that its prime object should be to facilitate the carrying out of scientific investigations, if necessary by the establishment of a State institution specially charged with the work of conducting them. Thirty years were still to elapse before Stokes' scheme was to be realised by the establishment of the National Physical Laboratory, the expenditure on which to-day is actually only a small part of the annual sum which the State devotes to scientific work. In those days there were many hotly opposed to the idea of a Government Department having as its duty scientific research. We ourselves were among the opponents of the scheme. Our view was that the foundation of such an institution would prove injurious, because it would result in attention being concentrated upon experimental inquiry and the amassing of new scientific facts, and would encourage a neglect of imagination and the ability to generalise. The groping spirit of research already possessed us, we argued, and it was highly desirable that we should raise ourselves above it. We also objected to the scheme because, we were afraid, it would be constantly open to the influence of "cliqueism and jobbery." Sad as it was, men of science, we wrote, were not invariably free from either of these influences. We cannot to-day defend with enthusiasm the attitude which we then adopted towards this very important subject or support with full conviction that they were sound the arguments on which that attitude was based.

850 B.H.P. AIRLESS-INJECTION OIL ENGINE DRIVING D.C. GENERATOR

RUSTON AND HORNSBY, LTD., GRANTHAM, AND MATHER AND PLATT, LTD., MANCHESTER, ENGINEERS



An 850 B.H.P. Enclosed Type Vertical Airless-Injection Oil Engine

WE recently inspected in operation at the Grantham works of Ruston and Hornsby, Ltd., an improved type of enclosed vertical oil engine of large output, which has been specially designed for electric lighting, industrial power, and marine auxiliary services. The engine we illustrate was built about a year ago at Lincoln, and after undergoing extensive bench trials it was transferred to the power station of the Grantham works, where it has been in constant operation on factory load since last October. Arrangements are now being made to increase the output still further by applying the "Büchi" supercharging system. A general view of the engine and generator is reproduced above.

As will be seen from the accompanying drawing, the new engine is a six-cylinder unit, and in appearance it has something in common with the large auxiliary generator engines which the firm has supplied to the motor ship "Dunster Grange" and other vessels. Indeed, many of the new features incorporated in design have been based on the successful operating experience gained with those marine auxiliary units. The main object of the new design is to simplify the construction of the engine and to give the most reliable and economical running over long periods. To further this particular end, the pressure lubricating system is furnished with a continuous filtering device, so that the supply of oil is constantly cleaned and renewed, and is not affected deleteriously, even with prolonged periods of working.

The designed output of the engine is 850 B.H.P. at full load, with an overload rating of 1000 B.H.P. for half an hour, the normal running speed being 250 revolutions per minute. As shown above, the engine is coupled direct to a 230-volt Mather and Platt generator of the outboard bearing type, which is of sufficient capacity to take the full load of the engine when it is supercharged. The cylinders each have a bore of 18¼in. with a stroke of 24in.

From the sectional drawings reproduced in Figs. 2 and 3, it will be seen that the bed-plate is of deep section, with a central oil sump and oil filling pipe. As the engine is run with a dry bed-plate, all oil gravitates to the sump. The crank shaft is stiff, and has a diameter of 11in., enabling short main bearings of large diameter to be employed. Its general design is such as to avoid torsional vibrations. It is supported in bearings of cast steel with white metal linings, and, as shown, the crank shaft is diagonally drilled for the pressure lubrication of the crank pins and connecting-rod top ends, by means of oil passing through the crank from the main bearings. As will be seen from our illustration, the crank case is robustly constructed, and it is of the monobloc type. When desired, for purposes of erection in mountainous districts, involving difficulties in transport, both the bed-plate and the crank case can be made in appropriate sections of moderate size and weight. The bed-plate and the crank case are secured to each other and to the foundation by a large number of closely spaced bolts forming a very rigid connection. This method has been chosen in preference to the more usual arrangement of a small number of bolts of a larger diameter. Attention may be drawn to the large inspection doors, which are hinged and held in position by quickly removable dogs. The doors are large enough to give full access to all parts of the bearings and connecting-rods, and to allow the skirt of the two-piece piston to be swung out with the gudgeon pin in position. To the left of Fig. 1 we illustrate the design of the piston and the connecting-rod.

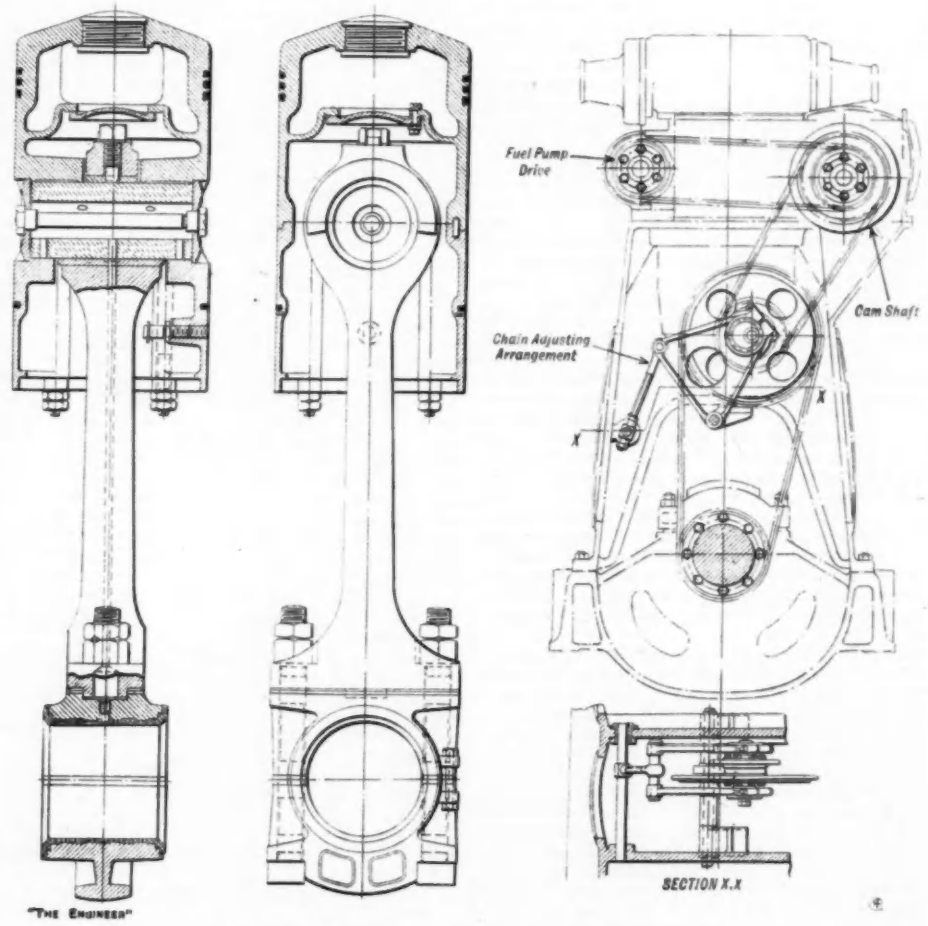


FIG. 1—PISTON, CONNECTING-ROD AND CHAIN DRIVE

It will be seen that a marine type of bottom end, made in cast steel and lined with white metal, is employed, while the gudgeon pin is of the floating type, with a stepped bearing and phosphor bronze bush. The piston is made in two parts, which are held together by four bolts. Immediately above the locking stud for the top end bush there is a dividing plate, which isolates the dome of the piston from the lower part, and prevents the access of oil and vapour to the underside of the piston head. The crown of the piston is slightly tapered to the sides to conform with the shape of the combustion space, and the piston head carries three rings, and the skirt an oil scraper ring. The

crown of the piston is supported by internal ribs, and is closed at the centre by a plug made of special heat-resisting steel. The liners, which are made of special cast iron and are finished by grinding, are reinforced by steel rings on the "Still" patented system for the larger part of their length, which enables a thin liner with good heat transmission to be employed in the region of the combustion space, and piston cooling to be dispensed with. The rings permit the access of coo ing water, which is contained in a water jacket of generous proportions, which at its lower extremity is provided with large cleaning doors. Each water jacket casting is furnished with a stout flange and the top of the crank case is bored out to receive the jacket casings, which are secured by the flange referred to. On the top of the jacket there is bolted the cylinder head, which is made in two parts. The lower part, which follows closely the shape of the piston head, is strongly constructed of special heat-resisting steel, and on the top of it is bolted the cylinder head proper, containing the valve seatings. As will be seen from the drawings, the air inlet and exhaust valves are horizontal and are arranged opposite to each other with the atomiser in a central position above them. On two of the cylinders there is also an air starting valve, and a relief valve is provided on each of the cylinders. The air inlet and exhaust valves are actuated by a cam-operated rocking lever through floating trunnions, the inlet valve being directly driven from the cam lever and the exhaust valve worked by a push rod. The cams and lever are enclosed in an oil-tight casing and revolve in oil, the oil level being maintained by a weir fed from the pressure supply.

To the right of Fig. 1 we illustrate the drive for the cam shaft and the fuel pumps. A vertical, inclined and horizontal drive, of the Hans Renold roller chain type, has been adopted, and the arrangement for adjusting the tightness of the chains includes a swinging triangular frame with an excentric movement for the centre wheels, which gives an independent adjustment for the drive from the crank shaft to the intermediate wheels and from that wheel to the cam shaft. The fuel pump is also chain driven.

In Fig. 4 we show sections through the fuel pump and the atomiser. The fuel pump is centrally placed, and it has a separate plunger for each cylinder, which works in conjunction with a spill valve, is provided. The amount of fuel delivered to the cylinder is varied by the governor, and a hand-operated emergency cut-off is also fitted. The particular design of spill valve employed has resulted, we

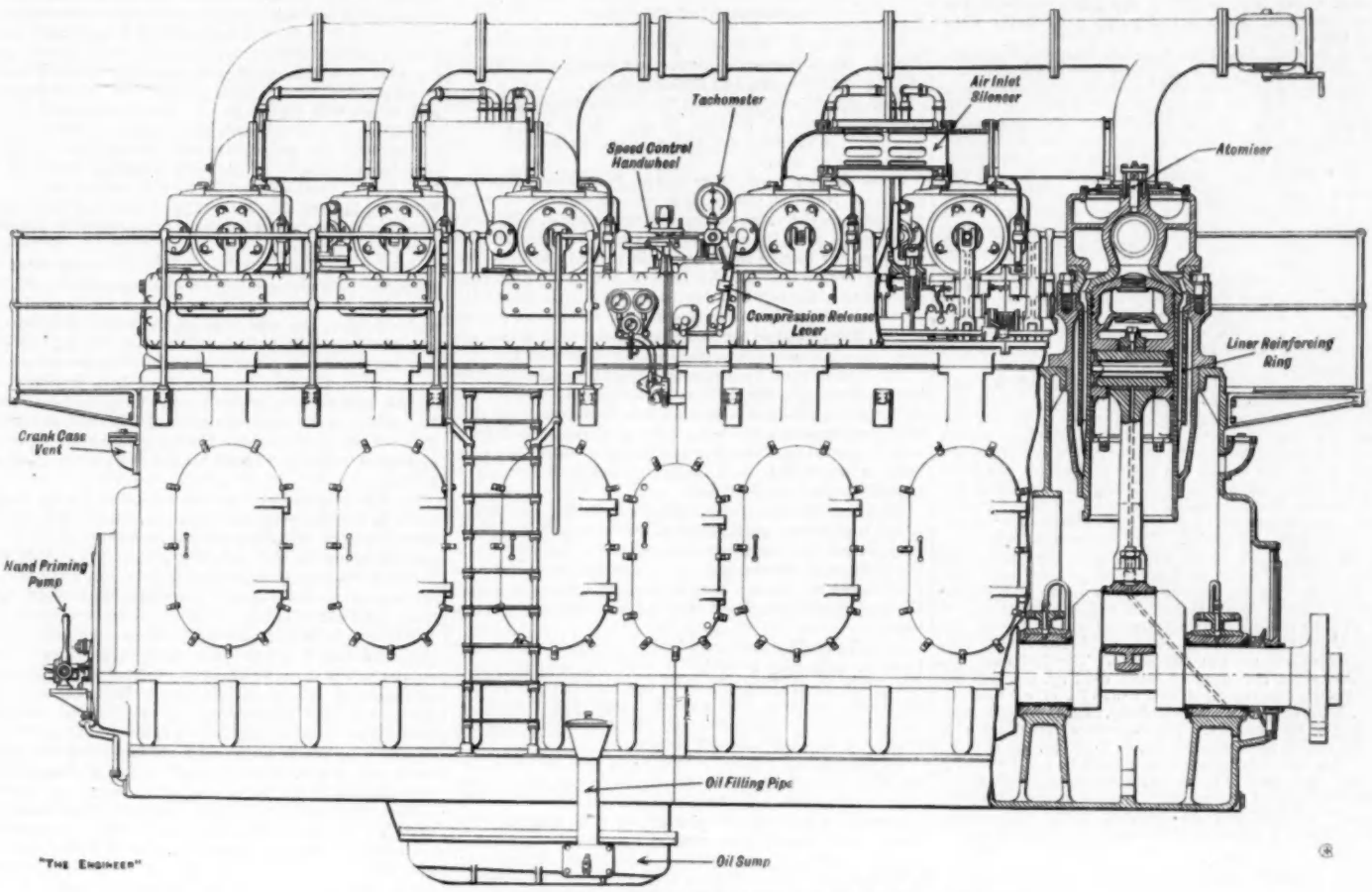


FIG. 2—ELEVATION AND PART SECTION OF 850 B.H.P. OIL ENGINE

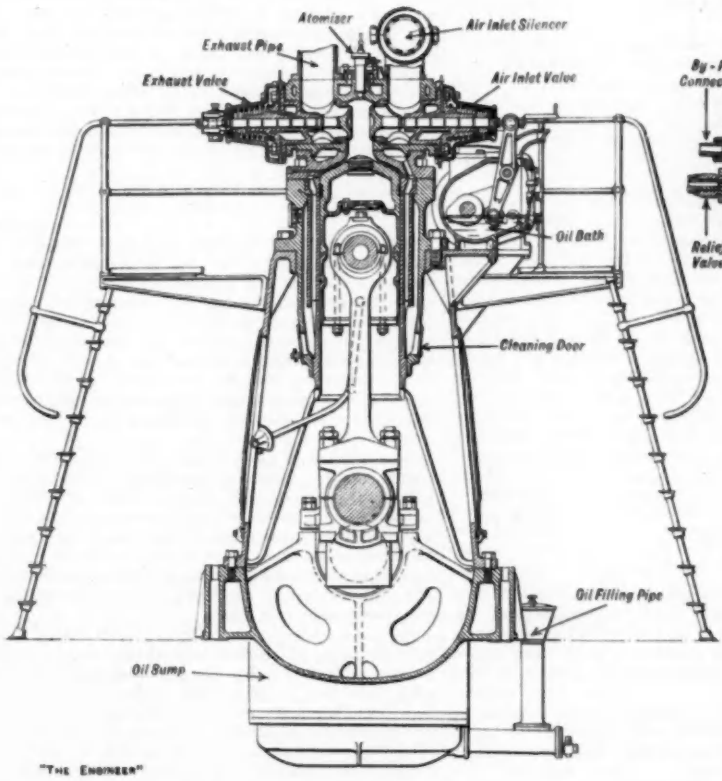


FIG. 3—SECTION THROUGH CYLINDER

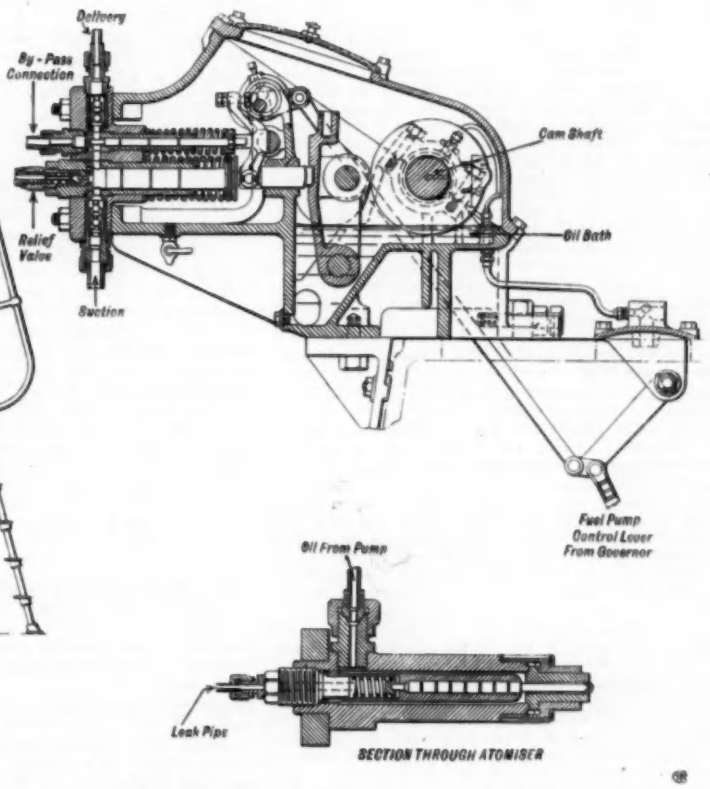


FIG. 4—ARRANGEMENT OF FUEL PUMP AND ATOMISER

learn, in the good balancing of all the cylinders and maintenance of cylinder power balance under load within exceptionally fine limits. As will be seen from the section given, the fuel pump cams run in an oil bath. The governor regulates the amount of fuel delivered, but the timing of the fuel injection is constant. There is a hand-speed regulator, which is arranged at top platform level near to the tachometer and the fuel pump unit on the front side of the engine.

The lubrication of the main bearings, reciprocating parts, cams and fuel pump, and oil baths and chain drives is maintained by a positively-driven force pump of the gear type, which is totally submerged in the oil sump. The liners are fed from special forced-feed lubricator units, placed below the back platform and driven from the engine. Where necessary, a surface type tubular oil cooler is fitted, and the "Streamline" filter attachment is in constant operation, being included in the oil pressure circuit. For starting purposes a small hand-operated oil priming pump is provided. At the generator end of the engine a large fly-wheel will be noted. It is furnished with the usual hand-barring gear.

At the time of our visit the engine was on factory load, and was running very steadily with a practically smokeless exhaust. The quiet running of the engine was assisted by the special silencers on the air intakes which consist of superimposed sleeves furnished with slots, which silently entrain the air.

The engine is started by compressed air, which is stored in a suitable container at a pressure of about 300 lb. per square inch. On opening the master valve, the air depresses the cam tappets of the two starting valves and admits compressed air to the cylinders at the correct timing. When the engine has got under weigh, the compression release valves are closed and the cylinders fire under the full compression. As soon as the starting air is cut off, the starting cam tappets are automatically raised from their cams, and are held clear of the cam surfaces.

At the time of our visit we found that the engine was running with normally cool cylinder jackets, and very even exhaust gas temperatures were being maintained on all cylinders. With regard to fuel consumption, we were able to obtain figures from the works log for the period from October 9th, 1929, until November 7th, during which the set ran 255 hours. The fuel used was Anglo-American Diesel oil of about 0·91 sp. gr., and the fuel consumption recorded was 0·378 lb. of oil fuel per B.H.P.-hour, or 0·52 lb. per kW-hour, based on a generator efficiency of 94 per cent. The amount of lubricating oil used per engine-hour was 2·8 lb., or 0·003 lb. per B.H.P.-hour. This improved type of engine will be constructed in standard sizes, both with and without supercharging, and the performance of the engine when supercharged on the "Büchi" system will be awaited with considerable interest, both by central station and marine engineers.

THE IRON AND STEEL INSTITUTE.

THE Autumn Meeting of the Iron and Steel Institute will be held at Prague, and the date for the opening of the meeting has been fixed for the week commencing Monday, September 15th. The sessions for the reading and discussion of papers will take place in the magnificent new building of the Society of Czechoslovakian Engineers in Prague. The programme will be approximately as follows:—

Monday, September 15th.—10 a.m.: General meeting in the Hall of the Society of Czechoslovakian Engineers. Welcome by the President of the Society of Czechoslovakian Engineers, by a representative of the Government, by the Primator of Prague (Dr. Baxa), and by representatives of the metallurgical and engineering industries. The ladies will inspect exhibits of Czechoslovakian glass in the Museum for Applied Art. 1 p.m.: Lunch at the House of Czechoslovakian Engineers. 3–6 p.m.: Visits to the sights of the town will be made in motor cars. 8 p.m.: A banquet will be held by invitation of the Society of Czechoslovakian Engineers.

Tuesday, September 16th.—10 a.m.: General meeting in the Hall of the Society of Czechoslovakian Engineers. Ladies: A special programme will be arranged. 1 p.m.: Lunch at the House of Czechoslovakian Engineers. 3–5.30 p.m.: Visits will be paid to places of interest in the city. 7.30 p.m.: At the National Theatre, a special performance of the national opera "Prodaná nevesta" ("The Bartered Bride") will be given.

Wednesday, September 17th.—8.30 a.m.–5.30 p.m.: Excursions to Czechoslovakian castles, namely, Karluv, Tyn, Krivoklát, Lány (the country seat of the President of the Republic). 8 p.m.: A reception will be held by a representative of the Government.

Thursday, September 18th.—8 a.m., about: Departure by special train, consisting of cars of the International Sleeping Car Company, to Pilsen, where the party will visit the steel works of the Skoda Company. The visitors will be entertained to lunch by the company. Afternoon: The party will inspect the Pilsen Brewery. After dinner they will leave Pilsen by the same train for Witkowitz *viâ* Prague.

Friday, September 19th.—8 a.m.: After breakfast the morning will be spent in visiting the iron and steel works at Witkowitz. The visitors will be entertained to lunch by the Bánská a Hutní Spolecnost (Mining and Metallurgical Company) of Witkowitz. Afternoon: A visit will be paid to the works of this company. In the evening a banquet will be held by invitation of the company. The party taking this excursion will spend the night at Moravská Ostrava (Mährisch Ostrau).

Saturday, September 20th.—9 a.m., about: Departure by the special train from Moravská Ostrava for Prague. 4 p.m., about: Arrival in Prague. 8 p.m.: A banquet will be held by invitation of Mr. Schneider, Past-president, chairman of the Union Européenne Industrielle et Financière.

Sunday, September 21st.—The party will leave Prague for the return journey.

A reception by the President of the Republic will be held at a place and time to be fixed later.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

DEFERRED PAYMENTS.

SIR,—It would be interesting to have further letters like Sir Alfred Herbert's in your last issue on the subject of Deferred Payments and Export Credits.

I am myself convinced that the Government's policy of encouraging export business is one which would bring not only the quickest but the most satisfactory increase in business at home.

Great Britain must, of necessity, be a large exporting country. Our last year's trade returns show a very big gap between the value of imports and exports, which has to be made good by other services and the interest paid to us on our foreign investments in order to balance our trading account. At the present rate this difference represents a figure which leaves us very little surplus to provide savings for reinvestment. An increase in export is, therefore, vital to Great Britain if she is to retain her position as a financial and trade centre of the world.

The type of export which would give the greatest benefit to our industries would be one which would contain the greatest proportion of labour, as it is by labour alone that additional wealth is created. To export goods which have been imported in a more or less finished state adds very little to the wealth of the country, and does nothing to help the industrial districts.

Sir Alfred Herbert states correctly that the Government is not required to participate in industry, but it is their duty to see that conditions are such that industry has a fair chance of succeeding. If, therefore, manufacturers could agree as to what is wrong with the conditions, then the Government should be approached to bring about this state.

As safeguarding has undoubtedly resulted in improved trade in industries to which it has been applied, surely the Government should consider very seriously its further application to other trades which decide that it would be advantageous to them, and which can show that it would not injure any other British industry.

As regards our foreign competitors, it is time that we left them to look after their own interests, and not to assist them to the detriment of our own manufacturers.

For the manufacturers themselves it is essential that they should have—(1) the necessary equipment to produce goods to compete successfully with their foreign competitors under fair conditions; (2) that they should have the organisation and facilities to sell such goods abroad.

I consider that for the first condition "rationalisation" is the most promising, as it would enable manufacturers so to rearrange their range of products that each works would be employed in making fewer patterns and a larger output of each. Larger outputs enables makers to use more special tools, and thus decrease the cost of production. This might even in the beginning reduce the amount of labour employed, but it would eventually provide an increase of work for labour, owing to the increased turnover resulting.

As regards the second condition, if the "rationalisation" is applied to a group of makers of sufficient turnover to justify a well-organised sales department, then this would, in itself, provide a cure. If, however, this should not be the case, it may be necessary for different "rationalised groups" to ally themselves with each other until the output is such as to warrant a properly organised selling organisation.

There is a very useful function which our Navy could now perform in the interests of British trade. British battleships and naval vessels generally are probably the finest product of British engineering. When the Navy is displaying the British flag in foreign ports, if some effort could be made to show the magnificent samples of engineering of which the Navy is composed, it would certainly be a very fine advertisement for the British engineering industry. Surely some co-operation between the British merchants abroad and the Naval Department, when the British Fleet is visiting such ports, would result in being able to display British production to a great advantage and profit. As we all hope a long interval may intervene before the time when the Navy will be engaged in warlike operations this period could be employed in the pursuit of peaceful operations in the furtherance of British trade.

H. C. SIDDELEY.

London, S.W. 1, February 5th.

SIR,—It is interesting to see the letters in your issues of January 17th and 24th from Mr. Gaudin and Mr. Siddeley. Before there can be a deferred payment there must be a credit given by someone to some other person who has to make the deferred payment. This credit may be justifiable. In practice, it occasionally turns out unjustifiable. The giving of credit, whether at home or abroad, is one of the reasons why merchants or intermediaries exist between the producer and the consumer. The merchant fills a distinctly economic function. The merchant is often called a "middleman," sometimes by a manufacturer greedy for more profit, and sometimes by a glib speaker who lives by attracting the popular vote in order to put himself into a position of place or profit.

All this talk about Governments providing trade or improving business wants careful examination. In many cases it is so much fustian. Credit is given to individuals and trade is done between individuals. Let us take a simple kind of case to illustrate principles. A young man wishes to start as an iron merchant or ironmonger, and as such wishes to maintain a small stock of bar iron or other goods. At the beginning he has a minimum amount of capital and wants the maximum encouragement or credit. If I know him to be a young man of good and careful character, who knows his business, is industrious and regular in his habits, and not lacking in common-sense judgment, I say this young man deserves encouragement. In the ordinary way, if he is in the home trade he will have to pay for his bar iron on the 10th of the month following that month in which the iron was delivered, but he is selling odd bars to local blacksmiths, small engineers and others who do not pay him for his supplies in sufficiently good time to enable him to pay me on the 10th of the month. He probably reveals the position to me and the class of persons to whom he is giving credit. I give him three months from delivery in which to pay me, believing in that time he will have collected various outstanding accounts and be able to discharge his obligation to me.

This kind of operation may be held to represent first principles in trade, and is no doubt applicable to all kinds of trade. At one time, for example, in the days of horses and carriages, the man who supplied the brougham and possibly maintained it in decorative repair, probably received £50 down and annual instalments from those who were his customers. Accounts have been known to run on this way for four or five years. Competition to secure the profits to the supplier under such a state of credit or deferred payment is one of the factors that destroyed this system of prolonged credit with a very high margin of profit.

In large transactions I can have recourse to my banker, and if he believes in me and my judgment and my prudence in taking risks, and has a general knowledge of my history and character, he will probably report favourably on me to other bankers or inquiries, and he will probably give me a credit at least equal to anything that might be got from the most generous of merchant intermediaries.

Where is credit for deferred payment wanted? I can understand an employee in a stable employment, with a regular salary upon which he can reckon month by month or quarter by quarter, contracting to buy a piano or small motor car, and undertaking to pay me an instalment monthly or quarterly out of his salary cheque. Those of us who were brought up under old-fashioned ideas which we regard as sound, have a habit of not wishing to enjoy anything until we have previously saved up sufficient money to acquire it without risk or embarrassment to ourselves in case of the happening of the unforeseen.

Fortunes have been made by sales of books, jewellery and other things on the instalment or deferred payment plan. Neither the books nor the jewellery were of necessity very first-class, and they certainly cost more than it would have been necessary to pay if the buyer could acquire them with cash in hand. I think the foregoing illustrates the principles involved.

I can understand a manufacturer seeing a great advantage from quality or regularity of product if he can install a new machine tool. He has a regular output and he reckons upon gaining an increased profit by the use of the new tool. It seems to me a perfectly legitimate operation for him to contract with the manufacturer of the tool to pay him in instalments over a period of time. There is no doubt that if this operation were repeated over a large number of people the tool maker would require to have a very large capital in order to be able to meet the requirements of his customer. In practice, we know that the tool maker very frequently requires a deposit or instalment of the purchase price from the buyer at the time of placing an order.

February 5th. H. J. SKELTON.

SIR,—Sir Alfred Herbert is quite correct; great differences of opinion in economic matters must exist because economics has not yet become a science in the sense that mathematics, physics or astronomy can be so considered. It remains full of dogma and possibly the economics of to-day will bear to the economics of the future much the same relation as astrology does to astronomy. So it comes about that my statement, "The consumer in return must receive money in excess of what he receives either in wages, salaries or dividends," before he can buy output is baffling.

It is difficult to express much in a short letter, and I readily admit I must have sacrificed clarity for brevity. I meant to convey that wages, salaries and dividends, *i.e.*, incomes of individuals, must always be less than the minimum prices that must be charged for the goods, and therefore, unless there is extra money available from some source to make up the difference between collective incomes and collective prices, the whole of the goods brought on the market cannot be sold.

For a complete proof of the above statement I would refer Sir Alfred Herbert to somewhat extensive literature on the subject, notably Messrs. Foster and Catching's work "Profits;" "The Flaw in the Price System," by P. W. Martin; and to the works of Major C. H. Douglas, for constructive suggestions to overcome this defect.

In practice one of the ways of partially overcoming this trouble is the deferred payment loan, which, while it boosts trade initially, does not do so in the long run, because the annual draft on the consumer's income is so large that there is insufficient left for current needs, ending in a collapse such as has recently occurred in the States. The easier the repayment terms are made the longer will the collapse be deferred, and the easier it will be for industry to balance its accounts. If Sir Alfred Herbert will follow this line of thought to its conclusion he will reach a result that will surprise him; but because it is quite unorthodox he must not conclude it is unsound.

Then with regard to the points emphasised both by Sir Alfred Herbert and Messrs. R. White and Sons of the importance of our overseas market to pay for our foodstuffs. I would not for a moment deny that if trade existed in the sense we are pleased to imagine it, *i.e.*, as an exchange of goods to satisfy wants, that the statement would be quite true. Actually, however, we are in a world of producers struggling for markets; thus, so far from there being a shortage of food in England, I seem to have heard recently of dumped German wheat. I believe this conception of what the state of affairs is, is a much more accurate one than that generally put forward and accounts for exports of boots and shoes from England to the States and *vice versâ*; for our sending coal to markets overseas at lower prices than to our own people; for exporting textile machinery which will become a rod to injure our textile trade; and for our importing motor cars, steel rails and many kinds of foodstuffs when we can produce them ourselves. With our present standard of living, if we were just exporting goods to pay for things we cannot possibly produce ourselves, I venture to say our overseas trade, genuine trade in this case, would be much less.

With regard to export credits and deferred payments to overseas customers, I do not mean to suggest that these people are trying to evade their obligations; on the contrary, I suggest that owing to financial difficulties, tariffs, and so on, the task not infrequently becomes impossible. Therefore I think it far better to give deferred payment terms to our people at home and keep your real capital at home than to send it overseas, because if payment is not made in money the assets are still under our home jurisdiction. Thus a farmer helped by receiving agricultural machinery is an asset to us at home, because he helps home-grown food supplies, whereas a similar farmer overseas may be quite unable to supply foodstuffs to us in return for several reasons—war, for example.

So really the crux of the whole problem appears to be a mathematical and accounting one. "Real economic progress," says the *Financial Times* of December 30th last, "in a capitalistic world is impossible without ever recurring writing-off of capital." This is a curious definition of "progress," and I wonder what the investors in the well-known electric company that had £1,750,000 written off its capital yesterday or the 100,000 extra unemployed that Mr. Thomas has promised us this week, think about it.

I do not support the deferred payment system except as a stopgap, and the finest thing any Government can do for this country is to find ways of improving the financial system so that producers can sell their goods; otherwise the struggle for markets will lead sooner or later to another war.

R. GANDIN, A.M. Inst. C.E.

London, February 5th.

RATIONALISATION.

SIR,—The British manufacturer is receiving a great deal of advice as to the way in which his business should be conducted, not always, however, from those who, by practical experience, are qualified to give it.

He is told that the way of salvation is to (*a*) contract loans with the banks to rehabilitate his plant, and (*b*) rationalise.

The individual employer has been hitherto inarticulate, possibly because he is fully occupied with his own affairs. As the output of privately owned undertakings exceeds that of the great combines and large public companies, which are accepted as representing our manufacturing interests, it may be well to put their views forward, as these are not invariably favourable to the suggestions mentioned above.

The advent of the Joint Stock Company undoubtedly stimulated trade, but it has been attended by disadvantages which are only too apparent at the present time and to which, in the writer's opinion, too little attention has been directed. The head of one of the largest industrial undertakings in the world has stated that "a limited company is not the best method of conducting a manufactory."

The opinion has been expressed by a foremost authority on engineering production that if a firm employing 1000 men desire to increase materially the number, better results will be obtained by starting a separate unit rather than by increasing the existing one. Another student of industrial production says: "Maximum efficiency is reached in a factory where not more than 600 workers are employed, and it is supervised by owners of wide experience."

These views are diametrically opposed to the merging of vast numbers of people under one control.

These statements are supported by the fact that a private enterprise can, and does, compete successfully with Government, Municipalities and combines, however powerful the last named may be.

The following, among other reasons, may be advanced to explain why this is the case:—

(1) The chairman of a public company is mainly concerned in placing an attractive balance sheet before the shareholders and in paying them substantial dividends. In a privately managed business these influences do not operate to the same extent; they are subservient to other considerations, such as discarding obsolescent plant, the adequate upkeep of premises, expenditure on exploiting new avenues for trade. The partners know what this expenditure is and the value of it, and are satisfied with a smaller return on capital, looking for an ultimate reward in the stabilising and improvement of their undertaking. If dividends are paid without these costs being adequately met out of revenue, a day of reckoning will be sure to come—and it has.

(2) In the privately managed business the human element is present. Workmen do not object to their employer earning reasonable profits, for they see him day by day working by their side, but they have very different feelings towards directors who put in an appearance at lengthened intervals and whose interest is mainly financial.

When business has passed certain limits the red tape worm appears gnawing at the vitals of it. Checks and counter-checks become necessary; jealousy among members of the staff appear, incentive to effort is discouraged and the domestic relations existing in smaller firms cease to exist.

(3) Any productive industry which has been subjected to the operations of the financier—and most of the great concerns have been—is conducted on a false basis and is generally unable to earn commensurate dividends on the capital employed, with the result that too often the business is starved.

It is submitted:

(1) That to borrow is a dangerous practice. It mortgages capital value and the interest reduces sums otherwise available for dividends.

(2) The employer must curtail personal expenditure and be more assiduous in pursuing his occupation.

(3) Every person paid for his services, whether director or office-boy, must pull his weight or go.

(4) Full advantage must be taken of the public services available—the physical laboratories, Overseas Trade Department, and the various associations existing to provide useful information and foster British trade.

(5) Trade jealousies must disappear; a distribution of the work each one is best able to do must be arranged and mutual assistance fostered.

(6) The greatest service a manufacturer can render to his country is to increase exports, giving more employment and assisting to balance our imports by exports.

Difficulties will not be overcome by speeches of public men and newspaper articles. There is no short cut to prosperity, concentration and hard work alone will do it. Rationalisation and borrowings are but quack remedies, if not actual poison.

T. A. WHEATLEY.

London, January 31st.

ENGINEERING AND AGRICULTURE.

SIR,—We have read with interest your leading article of last week, which must undoubtedly appeal to all engineers connected with agriculture. The general lack of orders prevailing among firms manufacturing for this trade is not a recent depression, and it would perhaps be too optimistic to say that the bottom of the curve has been reached.

As you rightly state, there has been little advance in the ordinary classes of barn machinery, mowers and binders; even such applications as ball bearings are notoriously few and far between. It occurs to us that this must either point to a certain amount of indifference on the part of the manufacturers or else that the machines themselves are considered to be beyond improvement in their present state.

In the last few years, perhaps the most noticeable advance has been in connection with the crude oil engine, which is undoubtedly the most economical form of prime mover, and the application of a moderate-powered engine of this type for use in a tractor should attract the attention of our manufacturers both for the home and foreign markets.

Apart from lighting purposes, the somewhat misused term of electrification can only be applied in the form of power for driving such machines as chaff cutters, &c., and even assuming that the mains were conveniently handy the running costs would probably be as much, if not more, than those of existing petrol-paraffin engines, bearing in mind the fact that only small powers are employed and then for only short periods.

Your mention of the sugar beet lifting and topping machines is of particular interest, and it is to be hoped that a practical machine will be evolved in this country before it is too late.

Your remark that agriculture is rapidly becoming industrialised, because the rural population is diminishing and more land has to be cultivated, is very debatable. It must be remembered that there was a definite turn against tractors some six years ago, and it is only during the last year or so that there have been any signs of this market reopening; even now sales are few and far between.

H. A. PANK, A.M.I. Mech. E.,
A. PANK AND SON, LTD.

Norwich, February 5th.

Royal Corps of Naval Constructors Annual Dinner.

THE annual dinner of the Royal Corps of Naval Constructors was held at the Park-lane Hotel, Piccadilly, on January 31st, 1930. This is more or less a private affair, a friendly family gathering, but the gathering was on this occasion of a somewhat exceptional character, so that some reference thereto may be excused. The company included three Directors of Naval Construction, the Director of Dockyards and his deputy, the Engineer-in-Chief of the Fleet, and also constructors attached to the delegations at the Naval Conference now sitting from France, Italy, Japan, and the United States of America. Mr. J. A. Yates was the senior retired officer present, and Mr. A. E. Richards, who is generally looked for at this gathering, had sent his regrets that he was unable to come owing to slight indisposition. Several other retired members of the Royal Corps of Naval Constructors were present. It was learned with regret that the senior retired member of the Corps, Mr. C. P. Lemon, late Chief Constructor, H.M. Dockyard, Sheerness, was lying dangerously ill in his home at Plymouth. They were glad to know that Sir W. E. Smith, who is now in his eightieth year, and has retired to Herne Bay, is in his normal state of good health. There are now only two surviving students of the Royal School of Naval Architecture at South Kensington, Sir William Smith and Mr. J. A. Yates. Sir William passed out of that school with a Fellowship of the First Class in June, 1873. In the autumn of 1873 the students were transferred to the Royal Naval College, amongst them being Mr. J. A. Yates, who passed out from Greenwich in 1875.

Mr. C. P. Lemon did not pass through a school of naval architecture, but he gained a position as an Admiralty draughtsman at a comparatively early age. He had a share, under the late talented Mr. J. A. Allington, in the preparation of the drawings of H.M.S. "Trafalgar" and "Nile," and so forms a link with a previous period in shipbuilding. In the summer of 1885 Sir Nathaniel Barnaby was unwell, and the late Mr. Henry Morgan, Chief Constructor, became the actual designer of these two ships, which apart from their somewhat low freeboard, were magnificent specimens of naval architecture in many ways. Before Sir William White took office, he had a consultation with Sir Nathaniel Barnaby respecting this design. They both agreed that the design was not to their liking, and requested that the drawings should be signed by Messrs. Morgan and Barnes to relieve them from any responsibility in the matter. The drawings were duly signed by Mr. Henry Morgan and the ships reached a very large degree of success, as stated above.

The gathering on January 31st indicates a much happier state of affairs than existed for some years after 1885. The members of the Royal Corps were delighted to have the presence of Sir Eustace H. Tennyson d'Eyncourt, Bart., K.C.B., who proposed the health of his successor, Sir William J. Berry, K.C.B., and who has recently retired. The present Director of Naval Construction, Mr. A. W. Johns, C.B., C.B.E., made a very excellent chairman. It was also a happy circumstance that Vice-Admiral A. B. Addison, C.B., C.M.G., the present Director of Dockyards, was there to propose the health of Mr. Johns, and he referred to the great friendship subsisting between himself and Mr. Johns and the Engineering-in-Chief of the Fleet. The Engineer-in-Chief of the Fleet, Engineer Vice-Admiral R. W. Skelton, C.B., C.B.E., D.S.O., responded for "The Guests" in the same friendly spirit. The Royal Corps of Naval Constructors contains within its ranks a number of very versatile members, and this was exemplified in a very amusing entertainment provided by them, notably two character sketches entitled (1) Ship Design in Fairy-land, and (2) When Women Rule, which earned very great applause. The toast of "The Chairman" was proposed by Mr. A. N. Harrison, Assistant Constructor.

J. H. N.

B.E.S.A. SPECIFICATIONS.

ELECTRICITY METERS.

Although a revision of the British Standard Specification for Electricity Meters was issued as recently as April, 1929, a further revision has now been published by the British Engineering Standards Association. The new edition, however, differs from the 1929 edition only in the addition of a clause relating to the standard terminal connections, and a series of diagrams illustrating these connections. These terminal connections are a mandatory feature of the specification, and therefore constitute a very important addition which is of interest to both manufacturers and users of meters. The specified limits of error, which were appreciably reduced by the 1929 edition, remain unchanged, and it is of interest to note in this connection that meters having an accuracy within the limits laid down by the specification would be classed as Grade I. if the proposals recently made by the International Electro-technical Commission become effective, the majority of continental meters, with larger tolerances on accuracy, being classed as Grade II.

Copies of this specification may be obtained, price 2s. 2d. post free, from the Publications Department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1.

LAUNCHES AND TRIAL TRIPS.

KAMPAR, motor ship; built by "De Maas" Shipbuilding Company, to the order of the Royal Packet Company; dimensions, length 165ft., breadth 28ft. 8in., depth 10ft.; to carry 400 tons deadweight. Engines, Sulzer 350 H.P.; constructed by Sulzer Bros.; launch, January 11th.

RANCAGUA, twin-screw oil tanker; built by Sir W. G. Armstrong, Whitworth and Co. (Shipbuilders), Ltd., to the order of the Chilian Government; dimensions, 378ft. by 49ft. 9in. by 27ft. 3in.; to carry oil in bulk. Engines, triple-expansion, pressure 180 lb. per square inch; constructed by the builders; trial trips, January 25th–27th.

GENOVA, twin-screw motor cargo ship; built by Harland and Wolff, Ltd.; to the order of the Argentine Navigation Company (Nicolas Mehanovich), Ltd.; dimensions, length 275ft., breadth 43ft., depth 13ft. Engines, two sets of six-cylinder trunk type airless-injection; constructed by the builders; launch, January 28th.

IRISBANE, twin-screw motor ship; built by Workman, Clark (1928), Ltd., to the order of Andrew Weir and Co.; dimensions, length 440ft., breadth 57ft., depth 38ft. 7in. Engines, Sulzer type; constructed by the builders; launch, January 28th.

SOUTH AFRICA, twin-screw oil tank motor ship; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Mr. Leif Hoegh for the A/S Noruega; dimensions, 499ft. by 65½ft. by 39⅝ft.; to carry oil in bulk, deadweight capacity 13,500 tons. Engines, two sets of Wallsend-Sulzer two-stroke engines; constructed by Wallsend Slipway and Engineering Company, Ltd.; launch, January 30th.

General Operation Experiences with the First "Wood" Steam Generator.*

By E. WATSON SMYTH, of Manchester.

(*Continued from page* 144.)

Operations During 1927.—The generator was again started during January, 1927, and from this period commenced to supply steam for works purposes. By putting other boilers also on steam supply efforts were first directed towards acquiring reliable data for the generator when working at minimum loads, and in order to accomplish this a slight modification to the air preheater was found necessary. It will be seen on referring to the general arrangement in Fig. 1, *ante*, that the forced draught fan is arranged centrally between the upper and lower air heaters. Thus the fan suction is connected to the upper air heater and its discharge to the lower air heater. The fan at the lowest speed was found to give an output in excess of that necessary to obtain satisfactory combustion at loads not exceeding 30,000 lb. to 40,000 lb. of steam per hour. This was remedied by the addition of canvas roller blinds, which were fixed in such a manner as to reduce the area of air inlet into the upper heater. This is now infinitely variable. A motor would require a very wide speed range to accommodate the range of load on the generator from 30,000 lb. per hour up to its maximum rating, and the method adopted for treating this excess of air supply was both simple and fully effective.

During the ensuing tests it was found that the priming difficulties had been fully overcome, and the temperatures of the steam, gas, and air were more satisfactory.

The results of a number of tests conducted during March, 1927, are set forth in Appendix IV., and it will be seen from test No. 1 that a mean load of 29,137 lb. of steam per hour was obtained. This is considered to be the lowest limit of output at which satisfactory combustion conditions can be maintained when operating with coal. With oil burners of the type illustrated in Fig. 12 a load of 20,000 lb. of steam per hour can be maintained if necessary. Oil burners are an essential feature of this plant for lighting off purposes, and they increase its range of evaporation to an extent conforming in the main to previous boiler standards.

The mean temperature of the superheated steam in the

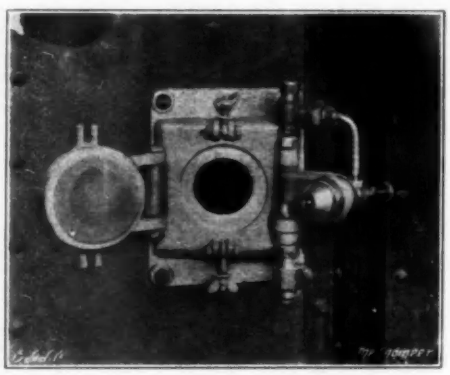


FIG. 12—OIL BURNER

first test—Appendix IV.—was 667 deg. Fah., and the mean gas temperatures recorded in Items 16 to 21 are of particular interest. Unfortunately, the special pyrometer and potentiometer for recording the higher temperatures above and below the water screen were not in order at the time the first test was taken, but in all subsequent tests these temperatures were recorded satisfactorily.

No. 3 test was made with the highest load officially recorded in this series, the mean evaporation reaching a total of 53,017 lb. of water per hour. Other boilers were under steam during this test, and it was not possible to transfer a greater load to the generator owing to the extreme fluctuations of the load which at this period it was not thought possible for the generator to follow without assistance from other steam generating units. In this test the mean temperature of the superheated steam was 748 deg. Fah., which was still considered to be on the high side for normal steel works practice.

The temperature of the gases entering the air heater had, however, been reduced to a mean temperature of 758 deg. Fah. No further anxiety was therefore felt as to the life of the air heater leaves on loads up to 60 per cent. of the total capacity of the generator.

The generator continued to work daily until September, 1927, a period of nine months.

Minor alterations were carried out during this period upon the pulverising plant, and from experiments made with coal varying both in moisture and fineness it was concluded that the pulverised fuel should not contain more than 5 per cent. of moisture and its fineness should be such that 93 per cent. would pass through a 100-mesh screen and 75 per cent. through a 200-mesh screen. This was quite easily obtained with little loss in output from the pulverising mill.

Slag Troubles.—The next difficulty encountered arose through ash and slag adhering to the vertical water walls and falling off in large pieces into the water screen tubes. This varied according to the kind of coal in use, and at the time it was found necessary to restrict the ash content of the coal to a maximum of 12 per cent.

Tube Failures.—It was then found that some of the centre tubes on the top row of water screen tubes had become badly blistered and had to be renewed. In endeavouring to trace the cause of this trouble the opinion was formed that the circulation in this row of tubes was restricted, and that if the circulation could be restricted in some of the other rows of tubes a more rapid circulation might be obtained in the top row, which, being situated in the hottest zone, needed it most. Ferrules were therefore fitted to the second and fourth rows from the bottom. Ferrules were also fitted in the side wall headers at the inlet to the bottom back drum, thus reducing the area of the openings by 20 per cent.

After further operation of the plant it was found that this alteration had not entirely overcome the trouble, for several more cases of blistering occurred on the top row of tubes. The reduction in area of the side wall headers appeared to make no difference to the circulation in the side wall tubes, for there was a complete absence of trouble at this time in any of the wall tubes.

A further modification was then considered. It will be seen in Fig. 13 that when the tubes rise to enter the front bottom drum they form an acute angle, the apex of which might conceivably cause a steam pocket and thus be the

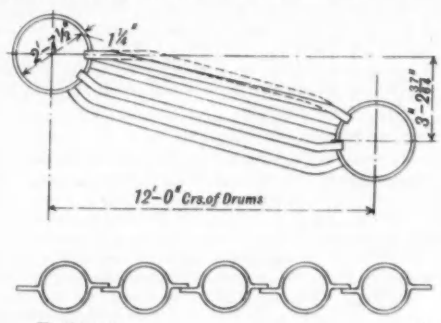


FIG. 13—MODIFIED ARRANGEMENT OF TUBES
FIG. 14—FIN TUBES

cause of the blistering trouble. It was therefore considered that the top row of tubes could be redesigned with advantage and the dotted lines in Fig. 13 show the new arrangement which was later proceeded with.

"Murray" Fin Tube Walls.—About July, 1927, it was observed that some of the fins on the front and side walls were burning away, thus reducing the heating surface exposed to the gases. It should be mentioned that when the generator was under construction Murray fin tubes were entirely new in this country, and the recognised practice in the United States was to arrange the tubes so that the fins overlapped, as shown in Fig. 14. This arrangement is probably quite satisfactory when the tubes are swept by gases spreading longitudinally over their length. In the case of the steam generator the gases are being swirled round the combustion chamber, and the projecting edges of the overlapping fins have a tendency to collect ash, with the subsequent burning of the fins. Further, since the combustion chamber had been submitted to some very severe treatment, particularly during the period of Mr. Kreisinger's tests, when the shortage of suitable coal caused difficulty in operation, it was not altogether surprising that the fins of the wall tubes should be showing signs of wear.

Superheater.—During August, 1927, after the generator had been in regular operation for a period exceeding seven

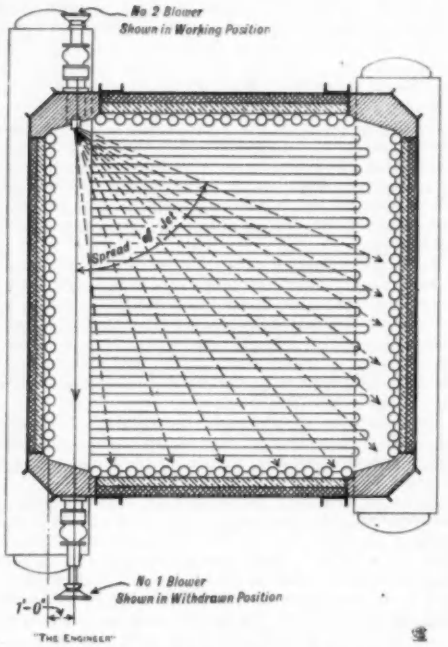


FIG. 15—ARRANGEMENT OF BLOWERS

months, the new superheater began to cause anxiety. Reference to Fig. 1 will show that originally the superheater elements were arranged to hang from the headers, which were situated directly below the air heater. Following the introduction of the economiser the superheater elements were placed horizontally, below the economiser, with the headers outside the back wall, whilst a special steel casing suitably lined with fire-brick and insulating material was provided to accommodate the headers. The superheater elements were supported by means of a cast iron girder built into the arches of the ash chamber, to which were attached metal hangers for holding the elements in position.

So great was the heat in the brickwork at this point that the cast iron girder commenced to sag and finally gave way, allowing a number of elements to bend and actually touch the floor. In spite of this deflection the superheater remained perfectly steam-tight, a tribute to the soundness of the manufacture of these elements.

Ultimately it was found that the greater number of the elements were touching the floor of the ash chamber. This condition permitted the ash to collect and build up over the elements and seriously impeded the draught conditions of the generator.

The unit was closed down on September 12th, 1927, for an examination, and it was decided that it was unsafe to keep the generator under steam in this condition. Consequently it was taken out of service for complete overhaul and for what subsequently proved to be the final modifications.

Final Modifications.—The following were the final modifications now carried out:—(1) The combustion chamber was entirely re-tubed with the new type of Murray fin tube arranged for the fins to be butt jointed; (2) the superheater was returned to the makers for straightening the elements and re-assembly; (3) a new design was prepared for supporting the superheater from the floor level, the previous cast iron girder being removed; (4) the ash chamber walls were altered again to the original design; (5) the economiser was entirely re-tubed, as it was found to be badly corroded; (6) a de-aerating plant was installed capable of treating 90,000 lb. of water per hour; (7) soot blowers were fitted in the combustion chamber; (8) a revision of the heating surface of the superheater and economiser was effected; and (9) the new arrangement of tubes for the top row of the water screen mentioned above was installed.

Superheater.—The revision of the heating surface consisted of the removal of seven elements. The heating surface has thus been altered as follows:—

	Square feet.
Original design, 1925	3470
First modification, 1927	1489
Final modification, 1927	1192

Economisers.—As it had been observed that at low loads the economiser had a tendency to steam, which necessitated by-passing a certain amount of water to the hotwell,

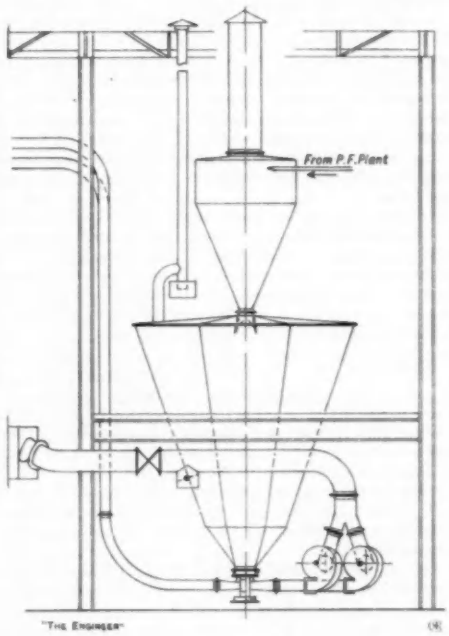


FIG. 16—CYCLONE SEPARATORS OVER BUNKERS

a reduction of the heating surface was effected at this period. Thus the heating surface of the economiser has been altered as follows:—

Original design, 1925	No economiser
First modification, 1927	2297 sq. ft.
Final modification, 1927	1838 sq. ft.

Soot Blowers.—The fitting of two "Parry" soot blowers represented an important addition to the combustion chamber. Fig. 15 shows the arrangement of the blowers and their respective ranges of action. It will be observed that the arrangement permits operation through a wide angle with the object of cleaning the side and back walls, and at the same time preventing the water screen tubes from becoming choked with slag or ash. Very special care was devoted to the design of the steam supply pipe work in order to prevent any possibility of water lodging and coming into contact with the tubes.

General Items.—At this period extensions to the works plant created an increased demand for pulverised fuel. This necessitated the construction of a central pulverising house into which the pulverising equipment was moved. The coal is now pulverised at about 500 yards distance from the generator house and delivered into a specially designed tank, which, by means of compressed air, shoots the pulverised coal to the various bunkers in the works.

Following the removal of this plant it was necessary to fit new cyclone separators over the pulverised fuel bunkers—Fig. 16—this being the only alteration necessary to this section of the plant.

(*To be continued.*)

* The Institution of Mechanical Engineers, January 24th.

INSTITUTION OF NAVAL ARCHITECTS.—The Council of the Institution of Naval Architects has awarded the Gold Medal for the year 1929 to Mr. John Johnson, chief superintendent engineer of the Canadian Pacific Steamship Line, for his paper "The Propulsion of Ships by Modern Steam Machinery," and the Premium to Lieutenant-Colonel F. Dondona, R.I.N., for his paper "Sea Trials of Italian Destroyers." The Medal and the Premium will be presented at the opening of the annual general meetings, which will be held on April 9th at the Royal Society of Arts, John-street, W.C. 2.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

General Situation.

TRADING conditions in the iron and steel and engineering industries of the Midlands and Staffordshire have altered hardly at all since my last letter. Demand in all branches is slow, prices are substantially unchanged and a rather subdued note characterised the Birmingham iron market this week. Engineering business has certainly not come up to expectations, so far, this year. January for most Midland manufacturers was unusually unremunerative. Works in the South Staffordshire area are mostly making a restricted output. Rolling stock makers, having received some useful orders, are well employed, and automobile engineers are doing better as the season draws nearer. Electrical engineers continue busy. With the future still clouded by uncertainties, industrialists hereabouts are inclining to pessimism.

Pig Iron Values.

As was anticipated, the Central Pig Iron Producers' Association, after reviewing its prices on the termination of the three months for which they were stabilised, decided against any alteration in the existing scale. The change of position over the last two or three weeks made its chances of being able to sustain increased selling prices very poor indeed. The market considered its decision the only possible one under the circumstances. Northamptonshire forge iron, consequently, remains at £3 11s. per ton, No. 1 foundry £3 18s., No. 2 £3 17s., No. 3 £3 15s., No. 4 £3 14s., delivered at stations in the Black Country. The minimum selling rates for Derbyshire brands are: Forge, £3 14s. 6d.; No. 1 foundry, £4 1s. 6d.; No. 2, £4 0s. 6d.; No. 3, £3 18s. 6d.; No. 4, £3 17s. 6d. There has been no improvement in demand since the Association's decision was made known. Consumers buy from hand-to-mouth and it is reported on 'Change in Birmingham this week that some blast-furnaces in Northamptonshire and Derbyshire are not now disposing of the whole of their output. If stocks of foundry iron exist, as stated, they can only be small. It is noted by consumers that the Pig Iron Producers' Association has indicated no time for the duration of its re-declared prices. Users are hopeful of a lowering of pig iron prices in the near future. Furnacemen's production costs are at last tending downwards. The coke position is easier and supplies are said to have been negotiated at 17s. 6d. per ton at ovens. The position in the pig iron and the coke industries is being closely followed.

Bar Iron.

The Staffordshire finished iron trade shows no important change. Marked bars remain the bright spot, and these are being absorbed regularly so that mills are able to make a fair output. Prices of Crown bars are sustained by the cost of production. The poor state of this branch of the iron trade restricts the demand for forge pig iron, stocks of which exist at most furnaces. Chain and cable iron is inquired for spasmodically. In the lower grades of iron, makers complain that orders are of a miscellaneous nature and of small content. Nut and bolt and fencing bars continue to be quoted at £9, but sales are few, Belgian competitors securing the bulk of the available business. Endeavours by some continental works to stabilise the price of No. 3 bars at £5 5s. f.o.b. Antwerp do not appear to have been very successful. Supplies are procurable at £5 1s. 6d. f.o.b. Antwerp. Wrought iron strip is not in such good call as it was, the local gas and water tube manufacturers being less regularly employed. Values are upheld at £11 2s. 6d. per ton, suppliers having tolerably good order books.

Steel.

There is no improvement on the week in activity in the finished steel department, nor has any new feature developed. There is a notable shortage of specifications for constructional work. The Midland yards are able to carry on with numerous small contracts, but the want of confidence which prevails throughout industry and the country generally retards engineering enterprise. Buying is purely of a hand-to-mouth character, consumers refusing to purchase material in excess of actual requirements. Prices of angles, joists, tees and ship plates are unchanged. In the half-products section local steel masters are meeting with no more success in their competition against the foreigner. Continental shippers are doing moderately good business here in bars, billets, &c., but recent efforts on their part to find increased outlets in this market have met with little success. Consumptive demand is below normal and here, as in other branches of the market, users refuse to buy forward. Small steel bars are now offered by local re-rollers at £8 per ton, which price compares with the continental one of £6 6s. 6d. Native mild steel billets are quoted £6 2s. 6d. upwards. Staffordshire hoops are priced at £10 per ton at makers' works. Demand for strip continues fairly good.

Sheet Prices.

Galvanised sheet prices have been steadied at £11 15s. per ton for 24-gauge corrugateds. Offers of orders at half-a-crown below this level have been rejected by local mills. Though buying shows some improvement alike on home and overseas account, it is of a restricted character, foreign buyers in particular being desirous of further testing the market before buying freely. Mills in this district continue to operate, but some really large orders would receive an almost boisterous welcome. It is worthy of note that in September last 24-gauge galvanised corrugated sheets sold freely at £13 7s. 6d. per ton.

Scrap.

Steel scrap remains a dull market, consumptive demand being small. Merchants are endeavouring to maintain prices and ask £3 7s. 6d. for delivery to South Wales, and £2 17s. 6d. for delivery into local works. Rumours that lower prices would be acceptable to some Birmingham sellers are unconfirmed.

Marking of Nuts and Bolts.

Manufacturers of both bright and black nuts and bolts in the Darlaston district of Staffordshire are keenly interested in the application under the Merchandise Marks Act for an order that imported bolts, nuts and rivets, set screws, head coach screws and boilermakers' and engineers' studs, should be required to bear an indication of origin. Manufacturers in this district who supported before the committee the application in regard to bright nuts and bolts and black nuts and bolts asserted that it is impossible for many of the users and ultimate purchasers to distinguish between British and foreign manufactures of these articles. It is stated that 90 per cent. of the manufacturers are in sympathy with the application. Shipbuilding interests are opposing the application.

Efficiency in Welding.

Under the auspices of the Institution of Welding Engineers, Mr. C. A. Hadley, of the AI Electric Welding Appliances Company, of Inverness and London, delivered in Birmingham on January 30th a lecture on "Modern Improvements in Electrical Resistance Welding Machines." He stated that the economic and commercial value of the electric resistance welding machine in its various forms was of ever-increasing importance. For all engineering purposes an efficiency of 100 per cent. was desirable and must be aimed at in order to obtain a reasonable latitude in the strength of the weld under working conditions. He described some of the technical difficulties in the way of producing welds of 100 per cent. efficiency, and his method of overcoming them. It was reasonable, he said, to expect that if proper metallurgical and physical conditions were observed, a weld of 100 per cent. efficiency could be obtained.

Railway Reconstruction.

The Great Western Railway Company has decided to widen the Paddington–Leamington–Birmingham main line between Olton and Bentley Heath, Warwickshire, and has placed the order for this work with the Cleveland Bridge and Engineering Company, Ltd., of Darlington. The work, I am given to understand, includes the widening and reconstruction of some seventeen bridges and the demolition and reconstruction of Olton and Solihull stations. A large amount of local labour will be employed.

Cannock Chase Coal Profits.

For the third consecutive month there is a profit to record in the working of the collieries in the Cannock Chase and Pelsall coalfield. In December there was an average profit on all coal produced in the area of 1s. 2·02d. per ton, compared with profits of 1s. 2·11d. per ton in November, and 4d. in October. The wages of miners during February, which are based on the ascertainment for the three months of October, November and December last, will remain at the minimum rate of 42 per cent. on the 1911 basis, although the owners' ability to pay is only 31·83 per cent. The owners' accumulated deficit under the wages agreement now stands at £1,156,766, a slight increase on the figure of £1,139,870 a month ago.

Unemployment.

Unemployment in the Midlands area continues at a high level, the total at date being 192,922. In this total are included 67,330 persons who are either on short time, or temporarily "stood off." A large number of the works in the area are doing only about three days per week, while others have since the year opened dispensed with the services of varying numbers of employees. The latest returns recorded an increase on the week of 3295. In the Birmingham area there are 28,306 unemployed; at Stoke-on-Trent, 20,825; Wolverhampton, 7740; Nottingham, 9675; Leicester, 8654; Coventry, 3158. In the Black Country district, Bilston has 2553 workless; Cradley Heath, 3506; Dudley, 3393; Smethwick, 2668; Tipton, 1817; Walsall, 5478; Wednesbury, 2467; West Bromwich, 2427; Oldbury, 1243; and Stourbridge and Brierley Hill, 3139. Of the grand total no less than 135,453 are men.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Fumes from Power Stations.

DR. S. L. PEARCE, who was formerly head of the Manchester Electricity Department and is now attached to the London Power Company, is to co-operate with the engineers of the Manchester undertaking in consequence of the House of Lords recent decision that the Manchester Corporation should get expert opinion with a view to obviating the nuisance caused by the emission of fumes from the super-power station at Barton. Dr. Pearce has written, it is stated, to the effect that his company is willing that he should place at the disposal of the Manchester Corporation the experience obtained by the company in the treatment of flue gases. In this connection it is of interest to note that a joint meeting of the Institute of Fuel and the Manchester Section of the Society of Chemical Industry at the Engineers' Club, Manchester, on Friday of this week will consider a paper by Professor M. W. Travers on "The Fundamental Problems of Flue Gas Purification."

Shipping Locomotives.

The Metropolitan-Vickers Electrical Company, Ltd., Trafford Park, Manchester, which is working on an order of the Great Indian Peninsular Railway Company for twenty-one electric locomotives, has just consigned the first which has been completed to Bombay direct from Salford docks. The locomotive weighs about 120 tons, and when placed aboard the steamer "Elysia" last week, special handling arrangements had to be employed. In view of the fact that a week ago the Vulcan Foundry Company, Newton-le-Willows, transported a large locomotive by road direct to Liverpool docks, some discussion has arisen as to whether Liverpool will become more prominent as a shipping centre for the products of Lancashire locomotive works. Beyer, Peacock and Co., Ltd., of Gorton, Manchester, and Nasmyth, Wilson and Co., Ltd., of Patricroft, as well as other firms, are expected to continue to employ the facilities of the Manchester Ship Canal. The Vulcan Foundry Company states that it will continue to use Manchester whenever it is convenient.

Southport's Sewerage Scheme.

An inquiry into the application of Southport Corporation to borrow £153,000 for a sewerage works was conducted by Mr. G. H. Thistleton Dyer, Ministry of Health Inspector, on Tuesday of this week. Southport's present sewerage system was established in 1880, when the population of the town was about 32,000, compared with nearly 80,000 now.

Iron and Steel.

New orders for pig iron on this market have been on rather quiet lines this week, with, however, fair deliveries being made to Lancashire foundries. Quotations for Staffordshire and Derbyshire No. 3 iron remain at 77s. per ton, delivered equal to Manchester, with Scottish and West Coast hematite iron both in slow demand, but steady at about 95s. and 92s. per ton respectively. With regard to finished iron, there is only a relatively small trade passing in Lancashire bars, with Crown quality quoted at £10 15s. and seconds at £9 15s. There has been no material improvement in the rate at which constructional steel materials are going into consumption in this area, and there is still complaint of under-employment by a number of firms in this branch. In the case of the locomotive industry, however, although not a great deal of actual new business has been reported, steady deliveries are being made against old contracts. Apart from small bright drawing bars which are in moderate demand, conditions in respect of the steel bar trade are slow, and inquiry for general plates on this market also leaves a good deal of room for improvement. So far as prices are concerned, however, steady to firm conditions continue in all sections of the steel market.

Reorganisation of Armstrong-Whitworth Works.

The historical armament works of Armstrong-Whitworths at Openshaw, which now form part of the English Steel Corporation's property, are in process of being adapted to commercial products and a considerable number of men are already finding employment in the various departments. A few days ago I had an opportunity of visiting these works, and was agreeably surprised at the amount and variety of the work in hand. One of the most important orders was a 2300 horse-power electrically operated geared winding plant for a mine in Rhodesia, which was approaching completion. This, I was informed, is to be followed by two larger plants of 3500 horse-power. On the firm's books is also an order for a 25,000 horse-power water turbine for New Zealand—the fourth for the same owners. Another department of the works is fairly well employed on pumps, one of which is a 500 horse-power steam hydraulic set for a steel works. In this connection it may be mentioned that the English Steel Corporation owns the manufacturing rights for the Boving pump, and also makes the Gill pump. The small tools department, which was once a very important section of the Openshaw Works, has recently been reorganised and additions have been made to the plant to bring it up to date. Other orders which were to be seen in progress were large six-throw crank shafts for marine oil engines, swaging machinery, the heavier portions of glass-making machinery, and pressings for motor car brake drums.

BARROW-IN-FURNESS.

Hematite.

The general tone of the hematite pig iron market remains about the same, and one is inclined to anticipate little change for some time to come. With local steel requirements maintained, the demand in the district will continue to be fairly good. The home market continues to be fair and steady, and there is just an inclination for prices to stiffen. Shipments abroad continue, and there are some more due. Business in special qualities of iron continues to be firm. The iron ore trade is fully maintained. In the Cumberland group more ore was raised last year than in any period since the war. The total tonnage was just over a million. Foreign ore is in steady demand at slightly reduced prices. The steel trade continues fair, and both at Barrow and Workington contracts will keep the mills engaged on railway material. The sleeper mill will restart at Workington next week.

Shipbuilding.

The rumour that Vickers-Armstrongs had secured an order for a 10,000-ton cruiser is denied officially. This rumour has been revived at intervals. At any rate, there is no truth in it at present. Vickers-Armstrongs are tendering for the new large Furness-Withy passenger vessel, which is to be driven by turbo-electric machinery. There is some delay in the placing of this order, and it may be a week or two before any announcement is made. The Isle of Man Steam Packet Company's new steamer "Lady of Man" will be launched from Vickers-Armstrongs shortly.

SHEFFIELD.

(From our own Correspondent.)

No Improvement.

THE hopes which were confidently entertained that the New Year would see an improvement in the general position of Sheffield trade have not been realised. On the contrary, a quiet spell has developed, and conditions are worse instead of better. The output and turn-

over of the city's staple trades this year up to date are considerably below the level of a year ago. There are many orders, but most of them are of small proportions, and plants have difficulty in keeping in operation without producing for stock. Inquiries generally are poor. There has been little change in open-hearth steel production, and the number of furnaces in operation is only about half of the total in the district. There is fair employment on the basic side, nine furnaces being at work at the Templeborough establishment of the United Steel Companies, while at the Parkgate Iron and Steel Works almost full capacity is being run. The production of billets, however, is an unremunerative business at present; in fact, makers state that at the current quotations they have been working for nothing for months. There is keen competition from the Continent, prices of certain qualities of foreign billets being from 20s. to 30s. per ton below those of local makers. In the acid steel department, business continues on a disappointing scale. The railway steel branch is still very inadequately supplied with orders. At the rolling mills work is very short, and a notable feature of the situation is the scarcity of orders for steel sheets. Long runs of work are few and far between.

Special Sections and Tools.

There is a brighter story to tell about various special sections of the steel trade, but here, again, conditions are not all that could be desired. Builders of automobiles are good customers for special steel and parts, but their demands have declined in common with other sections of trade. The requirements of the engineering trades for the various qualities of stainless steel, heat resisting and non-corrodible steels, are well maintained, and there is also a healthy call for cold wrought steel and strip. There is a shortage of orders for files. The large Russian orders for them and for other tools which are anticipated have not yet materialised. When they do come along they will be very welcome. Most sections of the tool trade find that business is below the normal level. The season for garden tools is proving unsatisfactory, as many dealers had large stocks left on their hands at the end of last year, and are consequently ordering sparingly. There is, however, a fair demand for scythes and garden shears.

Tires and Wagons.

The latest local order reported for railway carriage and wagon tires is one which Messrs. John Baker and Co., of Rotherham, has received from the Egyptian State Railways. There is still hardly any wagon building for private owners, but railway companies overseas continue to place orders for vehicles of this class, and firms in which Sheffield is interested are booking a fair share of them. The Metropolitan-Cammell Carriage, Wagon and Finance Company is to build 150 all-steel bogie covered goods wagons of 50 tons capacity for the Buenos Aires and Pacific Railway, and also forty bogie covered goods wagons for the Tanganyika Railway. The question of the size of wagons for the coal trade was referred to by Sir William Bird, chairman of the Wagon Finance Corporation, at the annual meeting in Sheffield last week. He said there had been many suggestions that wagons of 40 tons capacity should be used, but, while such vehicles might be all very well for a short journey between colliery and coast, for shipping purposes, they were really not wanted for general use. Very few collieries could take a wagon of 40 tons with their present screening plant, and that alone was a fatal thing, because in these days, with coal in a somewhat difficult position, the collieries could hardly be expected to alter their screening plant for the purpose of getting the wagons in. Sir William favoured the 12-ton wagon for convenience of handling in a colliery siding.

At Penistone and Tinsley.

The evil day for Penistone, when the works of the English Steel Corporation there will be closed, as part of the policy of rationalisation,, has been put off for the moment. The workpeople's notices expired last week-end, but the firm had said that they might be able to find employment after that time, though the engagements would be subject to termination without notice. There is a certain amount of work unfinished, and operations have been carried on during the present week. Two rolling mills and two steam hammers have been at work, providing employment for between 500 and 600 men. Two additional furnaces have been put into operation at the Vickers works in Sheffield, and it is probable that some of the men thrown out of work at Penistone will find employment there. The Penistone works are to be advertised for sale or to let. It is stated that the plant has been inspected by representatives of various firms, but whether that was with a view to negotiating for the purchase of the premises as a going concern, or any part of them, is not known. At the Tinsley Steel, Iron and Wire Rope Works of William Cooke and Co., Ltd., who recently announced their intention to close the wrought iron forge and bar mills, and put the men concerned on a month's notice, there is also a certain amount of work on hand, and, although the notices have expired, operations are being continued. It is understood, however, that it is only for a few weeks, and that the closing of the department is inevitable. The firm employs over 1000 men, and the number affected by the forthcoming closing is approximately 450.

Signs of Progress.

After this doleful paragraph, it is a pleasure to turn to something brighter, and to mention one or two cases of works expansion. There has recently been a change in the ownership of the old-established firm of Bell Brothers and Co., manufacturers of spades, shovels, and forks, Solferino-street, Sheffield, and the new proprietors have removed to a convenient factory at Heeley. The old premises have been acquired for the purpose of extensions by the Sheffield Twist Drill and Steel Company, Ltd., Summerfield-street. James Neill and Co., Ltd., manufacturers of composite steel, hacksaws, magnets, and safety razor blades, whose works are adjacent to those of the Twist Drill Company, are also about to carry out extensions.

Derby Railway Works.

The great reorganisation scheme at the Derby works of the L.M. and S. Railway Company, which is now completed, makes that railway centre the most extensive and up to date in Europe. Among other innovations, a system for the progressive repairing of railway carriages and wagons has been introduced, and it is stated that economies amounting to 30 per cent. will result from it. Coach bodies and chassis are repaired by gangs of men who work under and on top of them while they are being kept slowly on the move along the shop by means of an endless cable. On the arrival of the coach to be repaired, the top is lifted off by a crane, and the two sections of the vehicle move side by side on adjacent roads down the shop until they reach the end repaired and ready for assembly. Labour-saving machinery has been installed at the works on a large scale. In the sawmill, raw log timber, still green, is mechanically carried into the first of a series of fifteen machines, whence it is finally delivered cut, measured, and planed, without having once been lifted by hand. Similar reorganisation in the erecting shops enables a completely new freight truck to be turned out every half-hour, while a passenger coach can be put together in half that time. There are now in course of construction at the works some new passenger coaches, of both first and third class, which represent advances in travel luxury. They are 19in. wider overall than the most modern type yet built, have windows which give a better view, seats with more spacious accommodation, and doors and corridors designed to increase the comfort of the traveller by eliminating crowding. They will also be painted in a new and attractive style.

Hull Schemes.

The great scheme for abolishing the level crossings at Hull, to which I have referred more than once, and which was to have cost upwards of £1,100,000, has been turned down by the ratepayers. The financial provisions did not commend themselves to various business interests, and when a poll of citizens was taken the scheme was defeated by 32,319 votes to 2854. The proposal that the Corporation should acquire the Queen's Dock estate, fill in the dock, and make a boulevard in the centre of the city, has made further progress. A special committee of the Corporation has confirmed an agreement for the purchase of the estate for something like £100,000, subject to satisfactory explanations being received by the Town Clerk on one or two outstanding points. The Hull Chamber of Commerce and Shipping is, however, opposing the scheme, as it considers that the dock should remain. The Chamber's legal adviser has stated that he believes that the estate would revert to the Crown, which gave the land, if the dock ceased to be used for its original purpose. The dock was made under the first Dock Act of 1774. Other works before the Hull Council just now include street and sewerage improvements, involving a total expenditure not far short of £100,000.

Cutlery and Plate.

The cutlery and plate trades, like the steel trades of Sheffield, have started the year anything but well. The improvement which usually takes place in February has not manifested itself. A few special orders have been placed, but otherwise no business of importance has come forward, and the general position does not compare at all favourably with that of last February. The Admiralty and War Office are in the market for their annual supplies, and competition for the contracts is likely to be exceptionally keen.

NORTH OF ENGLAND.

(From our own Correspondent.)

Iron and Steel Exports.

IRON and steel exports from the Cleveland district during January showed some improvement upon those for December, but the aggregate of 71,471 tons fell well below the monthly average for last year. Throughout the month the foreign demand for steel was extremely limited, and although pig iron shipments showed a slight improvement, the area of distribution for Cleveland pig iron is very circumscribed. Midlands iron is actually being used in this district. It is competing also in the Scottish market, where also a certain amount of Indian basic iron is in use. Thus, Tees shipments of pig iron to Scotland fell below 5000 tons for the month, and it is reported that big sales of French pig iron to Scotland have been negotiated. The exports of pig iron totalled 16,656 tons, of which 8796 tons went to foreign ports. An interesting feature of the manufactured iron and steel shipments was the despatch of a cargo of nearly 1000 tons to Canada. The Argentine was also a substantial customer, whilst 9084 tons went to African ports. Australia, too, figures prominently with 8285 tons, but the total of 7780 tons to India, Ceylon and Burmah was well below the average. The finished iron and steel exports totalled 54,815 tons, of which 40,912 tons went overseas.

Wages Shock for Coal Miners.

Earnings in the coal industry in Northumberland and Durham in the month of December—which govern the wages payable to the miners during the current month—showed a considerable decline. The Northumberland ascertainment was a great disappointment to coalowners and miners alike, as it had been confidently expected that, for the first time since the minimum wages agreement came into operation in February, 1928, the minimum wage of 40 per cent. would be exceeded. So confident were the owners of this that they had already, in a generous gesture, agreed to share with the miners any excess over the 40 per cent. minimum, though they are entitled to recoup themselves for the big deficit of previous years. The joint ascertainment for Northumberland showed that the wages payable to the piece workers in February would have been 23·92 per cent., but for the operation of the minimum of 40 per cent. a reduction of 15·41 per cent. on the previous month. Instead of having something over the 40 per cent. to share with their workmen, therefore, the coalowners are called upon to increase their deficit further by adding 16·08 per cent. to the miners' wages in order that the 40 per cent. may continue to operate. Durham's figures show a percentage of 47·56 in December, a decrease of 10·68 per cent. on the preceding month. The minimum of 65 per cent. will continue to be the basic wage in February. The causes of the decreased earnings of the industry are various. December is always a bad month, because of the intervention of the Christmas holidays and consequent absenteeism from work, but the position was made worse by the gales, which disorganised shipping and, consequently, dislocated the coal trade.

Cleveland Iron Trade.

Business continues on a most disappointing scale, and the possibility of a reduction in the number of operative blast-furnaces is by no means ruled out. Customers are showing a marked disinclination to negotiate for extensive forward supplies, holding that values are more likely to fall than otherwise, though producers protest that the situation does not admit of price concessions. Substantial sales of French pig iron to Scotland limit the possibilities of the sale of Cleveland iron in that area, and if imports of foreign iron into the Tees have almost ceased, exports are also dwindling. Moreover, several steel furnaces in the district have been laid idle, so that domestic consumption of pig iron is also reduced. Nevertheless, makers still adhere to the fixed quotations, No. 1 foundry being 75s.; No. 3 G.M.B., 72s. 6d.; No. 4 foundry, 71s. 6d., and No. 4 forge, 71s.

Hematite Pig Iron.

Unsatisfactory accounts are given of the East Coast hematite pig iron trade. Sales are not easily arranged, and quotations tend downward. Merchants have bought a good deal of iron, in the disposal of which they have a free hand, and they are selling freely at a shilling or two below cost of production. Market quotations are not above the equivalent of ordinary qualities at 78s.

Ironmaking Materials.

Transactions in foreign ore are little heard of. Odd cargoes are stated to have been sold at low figures. Best Rubio ore is in the neighbourhood of 22s. 6d. c.i.f. Tees. Blast-furnace coke is plentiful, and prices are weak. Consumers state that they can satisfy their requirements at a little below 22s. for good average qualities delivered at North-East Coast works.

Manufactured Iron and Steel.

The manufactured iron and steel trade presents no new features of moment. Producers have still a lot of work to execute, but forward orders would be welcome. Shipbuilding specifications are being distributed fairly freely, and departments turning out railway material are busy, while producers of requisites for bridge building keep active, but sheet makers are much in need of work and are cutting prices. Galvanised corrugated sheets—24in. gauge—are now no more than £12 per ton.

The Coal Trade.

There are signs that the northern fuel market is developing an easier tone. Gas and coking coal collieries are well sold for months ahead, and some of the steam coal pits have a lot of trade in hand, but there are others which have not booked much fresh business in the last week or two. There is still a good deal of cheap coal, bought nearly a year ago, to be delivered, and second-hand holders seem to be more desirous of realising before prices assume a possible downward tendency. Prompt orders may come along to keep up the strength of the general position, but the outlook as a whole is less rosy than it has been. Steam coals have been a strong feature throughout the winter, but a quieter feeling is now manifesting itself. Buyers on the Continent have been waiting for anything that may result from the Coal Bill, and now they are to a considerable extent keeping off the market in the hope of a decline in values. In the meantime most of the steam coal collieries are well placed for orders and tonnage is ample. Forward trade, as already indicated, is of a halting character, and with production as high as it is at present in all countries a great volume of sustained business is required to clear it. The winter is rapidly advancing, and there are no signs of hard weather anywhere in Northern Europe. Thus the accumulated stocks of fuel against frost emergencies will be drawn upon before fresh buying is contemplated. Steam coal sellers are fairly numerous for later in the month, but there are few for prompt positions. Best Northumberland qualities range lower from 16s. to 16s. 9d., and other descriptions are easy in trend at from 15s. to 15s. 6d. Steam smalls are in good request, but in limited supply, and the market is very strong at 11s. to 12s., according to grade. Durham steams show no material change, large continuing at 17s. to 18s., and smalls at around 14s. The coking trade is strong owing to the full turns, and good qualities make 15s. 6d. to 16s. Coking smalls are easier to obtain at about 15s. to 15s. 3d. These figures do not hold for backward positions, however. The gas coal position is rather quiet, but on the whole best qualities are steady at 16s. 9d. Secondary kinds are slightly easier at 15s. 3d. to 15s. 6d. Durham coking unscreened continue to move freely and are fairly well held at 15s. 6d. to 16s. 3d. Unscreened bunker coal is steady at 16s. 6d. to 17s. for bests and superiors, but ordinary descriptions are irregular at 15s. 3d. to 16s. There is no special feature in the coke trade, which remains dull and values are at an easy level. Gas coke is offered at 25s. without attracting buyers. Patent oven coke is steady for best grades at 26s. to 28s., but ordinary qualities are easy at 19s. to 20s.

SCOTLAND.

(From our own Correspondent.)

Shipbuilding.

DURING the month of January fifteen vessels of 31,910 tons aggregate were launched from Clyde shipyards. Though these figures are not particularly high, they still represent a very fair average for the month, and have only been exceeded on five occasions since the year 1919. Both from the point of view of tonnage launched and contracts announced, it is argued that a good start has been made for the present year. The prices obtainable for new vessels are still below what is considered to be a remunerative level, but there appears to be every prospect of continued good relationships between employers and men, and of comparatively good employment throughout the year, equal, at any rate, to the standard of 1929. Of the vessels launched, three were of 5000 tons or over, and were as follows:—"Clan Macalister," cargo steamer, 7000 tons, built for the Clan Line Steamers, Ltd., Glasgow; "Ramsey," twin-screw, 6000 tons, for the Bolton Steam Shipping Company, Ltd., London; and the "Princess Elizabeth," twin-screw turbine, 5000 tons, for the Canadian Pacific Railway. The majority of the contracts announced during January were for vessels designed to carry oil in bulk. The Anglo-Persian Oil Company has ordered five such vessels, two of 6500 tons deadweight and three motor ships, each of 10,000 tons deadweight. A similar ship of 11,250 tons deadweight is to be built for New York owners.

Steel.

Nothing of outstanding note has taken place in the steel trade during the past week, and business in all branches continues quiet. Plates and sections are not particularly active at the moment, but an early improvement is anticipated. Black sheets are comparatively busy, but galvanised descriptions are dull, and prices weaker. Tubes are only in moderate request.

Wages in the Steel and Iron Trades.

Wages have been under discussion at a conference held in Motherwell between representatives of David Colville and Sons, Dalzell Steel Works, and the men's delegates, with a view to an adjustment being made. A new agreement has been reached affecting several thousands of the workers at the Dalzell works. With the exception of tradesmen, all the workmen are embodied in the new scheme, which, it is said, will work out advantageously for the lower-paid men, as bonuses and other temporary payments to these workers on tonnage rates will be given a more permanent form. There is an all-round adjustment of tonnage rates, allowing for a levelling up of wages favourable to the lower-paid workers. At Motherwell Ironworks, on the other hand, about 200 men are working under protest owing to a reduction in wages, in consequence of an alteration in the basis of payments. Apparently, it has hitherto been the custom in ironworks when a mill is on steel—which is easier wrought than iron—to pay the workers iron prices, which are from 16½ to 17 per cent. higher than the steel rates. The question in dispute is one affecting the trade generally, and is not likely to be confined to Motherwell.

Iron.

Bar iron makes little or no headway, and is extremely dull, a remark which also applies to re-rolled steel bars. The latter are still round about £7 12s. 6d. per ton home or export. Pig iron is steady, though slow, with prices remaining at the last fixed minimum level.

Coal.

The coal market is dull in all branches. Exporters find great difficulty in influencing business, and are now being asked to take up contracts by the collieries, many of which now find some trouble in disposing of their outputs. Lanarkshire ells and splints, especially the latter, are still fairly well placed, but other descriptions of round fuels are in need of fresh business. Small stuffs are weakening, with the exception of pearls, which still have a ready sale for early shipment. Aggregate shipments amounted to 245,686 tons, against 279,801 tons in the preceding week, and 220,912 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Trade Conditions.

SHIP-REPAIRING operations continue on quite an active scale, but so far as the iron and steel and tin-plate industries are concerned, there is no improvement. In the coal trade the conditions appear to be somewhat irreconcilable. To all outward appearances there is very little business passing, and yet shipments maintain a very good level. It is true that according to the returns of the Great Western Company, shipments at the six ports controlled by it were last week less by just over 50,000 tons than the total for the preceding week, but the surprise is to many that the total should have been so high as 603,000 tons. The fact that chartering operations of late have declined has not so far affected the position, and the only explanations that can be given are that more business than ever is being done direct by the great combines, and does not therefore come on the market in the ordinary way, while, furthermore, there is no doubt that more tonnage has been taken up on voyages over six and twelve months than was generally thought to be the case. At the end of last week the supply of tonnage in dock was undoubtedly inadequate to the needs of many collieries, but fortunately arrivals over the week-end were very satisfactory, with the result that on Monday there were eleven idle tipping appliances with twenty-two steamers waiting to get into berth, while on Tuesday the loading position was even stronger, inasmuch as the number of idle tipping appliances was reduced to four and the total of waiting steamers was without alteration. It is true that the general inquiry from abroad leaves much to be desired, and it is strange that many foreign consumers display reluctance to purchase now when c.i.f. prices are in some cases 2s. or more below the level at which sales were being effected last autumn. Prices are more likely to advance than to go any lower, as there is evidence of outward rates of freights being on the turn, and sellers are certainly not disposed to operate ahead on the basis of current freight rates. They are bound to cover themselves against a possible and probable recovery. So far as contract business in steam coals is concerned, it is understood that the Central Railways of Brazil are in the market for 200,000 tons of two-thirds large and one-third smalls for delivery at Rio de Janeiro from March to July next, while the French Marine is asking for prices for supplies of coals for some of their naval stations.

Shipping.

Since I wrote last week the position of shipowners has, if anything, become worse instead of showing any improvement. There has been a further fall in outward rates of freight for all directions, with the exception of South American destinations, from which quarter homeward rates are deplorable and unremunerative. The rate at which tonnage is being laid up is increasing, and some steamers are now on their way home from the River Plate in ballast to be laid up. Nearly half the fleet of one of the largest shipowning firms in Cardiff is laid up, and, as a matter of fact, so many steamers are in local ports out of commission that the Great Western Railway Company has announced that only steamers coming into port to load or discharge cargoes will be permitted to enter the docks, owing to the congestion prevailing. Shipowners state that the conditions generally are worse than they have been for many years. Business is difficult to obtain for tonnage, and what is available is wholly unremunerative.

Tin-plate Trade and Foreign Competition.

Speaking at the annual meeting of the South Wales Siemens Steel Association Conciliation Board at Swansea last week, Mr. Frank Rees, the President, said that the British steel output in 1929 was almost a record at 9,654,000 tons. In the area covered by the Siemens Steel Association the total was 1,485,400 tons. This was approximately 15·3 per cent. of the whole, but in 1923–4 they produced 18 per cent. of the country's output. The tin-plate output in 1929 was a record, but the sheet trade struck a very bad patch, which had been reflected in the bar requirements. This was due to foreign competition. The bulk of the tin-plate manufactured to-day in South Wales was manufactured from Welsh bars, and whatever effect the lower prices of foreign steel might have on the stability of tin-plate prices, the tin-plate trade had secured prices for its product which covered the price of Welsh steel. In other words, the importation of foreign steel was not essential to the existence and well-being of the South Wales tin-plate trade. He added that other parts of the country held considerable advantage over West Wales in connection with working agreements, and they would shortly apply for a revision of agreements locally.

Mines Bill.

The secretary of the Welsh Plate and Sheet Manufacturers' Association has forwarded to the President of the Board of Trade on behalf of the tin-plate trade a communication which sets forth that the executive of his association, which controls 99 per cent. of the output of tin-plates, black plates, and terne plates manufactured in Great Britain, and whose members pay approximately an annual wages bill of four million pounds, views with alarm the provisions of the Coal Mines Bill, as it is satisfied that in its present form the Bill must inevitably increase the cost of coal and steel and seriously restrict the members' ability to secure orders for their products or to provide employment for their workpeople. South Wales anthracite coalowners at Swansea on Monday also passed a resolution to the effect that, representing 100 per cent. of the anthracite coal produced, other than that of the Amalgamated Anthracite Collieries, Ltd., they lodged their strongest protest against the provisions of the Bill dealing with compulsory amalgamations.

Current Business.

New business is quiet, and yet coals are moving off very freely, except in the case of large coals, for which prompt orders are by no means adequate to the requirements of collieries. The feature of the market is the firmness of smalls, which are extremely scarce, but sized coals are irregular. Coke is more easily obtainable, but patent fuel manufacturers are in a comparatively good position for early positions. Pitwood is a shade steadier.

CONTRACTS.

THE BRITISH THOMSON-HOUSTON COMPANY, Ltd., Rugby, has received from the High Commissioner for India an order for four water-wheel driven self-contained alternator sets to be used in the Shanan Power Station in connection with the Uhl River hydro-electric scheme. Each alternator will be driven by a Boving water wheel and will have an output of 12,000 kW—16,000 H.P.—the rating being 13,333 kVA, 0·9 power factor, 11,000 volts, three-phase, 50 cycles, 428½ r.p.m. The same company has also received an order on behalf of Australian Ore and Metal Proprietary, Ltd., for six 2500 kVA—2700 H.P.—alternators and the whole of the switchgear for a central station for the supply of electric power to the mines of North Broken Hill, Ltd., Broken Hill, South, Ltd., and the Zinc Corporation, Ltd., Australia. In addition to the foregoing, the British Thomson-Houston Company has received orders for outdoor-type transformers required in connection with the electrification scheme.

THE BRITISH GENERAL ELECTRIC COMPANY, of Wellington, N.Z., has recently received an order from the Auckland Electric Power Board for two 1000 kW, 750 r.p.m. motor-started rotary converters, each with its 1100 kVA, three-phase transformer, and fully automatic switchgear for the converters and four track feeders. For the interconnection of the Waitaki—110 kV—and Lake Coleridge—66 kV—power schemes in the South Island, the same company has received an order for seven 5500 kVA, 63,500/38,100 volts outdoor type single-phase auto-wound transformers of the oil-immersed type, fitted with detachable cooling radiators. An unusual feature will be a 11 kW tertiary winding, to allow each bank to supply power to a 10,000 kVA synchronous condenser. In addition, the same company has also received an order for auxiliary generating plant and switchgear for the Waitaki power station. This includes two 315 kVA, 420/410-volt, three-phase, 50 cycles alternators and two 120 kW, 230-volts D.C. generators, an eight-panel, 429 volts A.C. flat-back switchboard and a six-panel 220 volts D.C. flat-back board.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

MR. HAROLD C. KING has been appointed engineer to the City of Amsterdam in the capacity of consultant.

MR. W. SIMMONS, A.M.I. Mech. E., late works manager of Gleniffer Motors, Ltd., of Glasgow, has been appointed general manager of Alfred Wiseman, Ltd., Birmingham.

THE COVENTRY VICTOR MOTOR COMPANY, Ltd., has been awarded the diploma of honour at the Barcelona Exhibition for its exhibit of Coventry Victor three-wheelers, three-wheeled delivery vans and engines.

BRITISH REVERBERATORY FURNACES, Ltd., asks us to announce that its only address is now 88, Kingsway, London, W.C. 2. Telephone: Holborn 3622. Telegrams: "Furnaces," c/o Tramway, Phone, London.

MR. T. H. U. ALDRIDGE has relinquished the office of vice-president and general manager of the Shanghai Power Company in order to become associated in London with the American and Foreign Power Company.

COMBUSTION STEAM GENERATOR, Ltd., asks us to announce that its address has been changed from 1, Southampton-row, W.C. 1, to Africa House, Kingsway, London, W.C. 2. New telephone number, Holborn 2002; telegrams as before, Steamgener, Westcent, London.

D. NAPIER AND SON, Ltd., of Acton, ask us to announce that Mr. G. S. Wilkinson, who has been their chief designer for many years, has been appointed chief engineer to the company and that Mr. C. Charles, late director and works manager of Dennis Bros., Ltd., of Guildford, is taking up the position of works manager at Acton.

ROYAL INSTITUTION.—At the general meeting of the members of the Royal Institution, held on Monday, February 3rd, Sir Robert Robertson, Treasurer and Vice-President in the chair, Mr. Rollo Appleyard, Sir Herbert Baker, Mr. A. Carpmael, Mrs. Drysdale, Commander R. T. Hanson, Colonel G. C. I. Hervey, Commander H. L. Hitchins, Mr. R. W. King, and Mr. G. P. Shakerley were elected members.

NEW DETROIT RIVER BRIDGE.—In our issue of December 20th, 1929, in an item under Canadian Engineering News, page 657, we make a statement of "another bridge across the Detroit River between Amherstburg, Ontario, and Grosse Point, Michigan." It has been pointed out to us that the statement should have read "between Amherstburg, Ontario, and Grosse Isle, Michigan," Grosse Point being about 25 miles up the Detroit River from Amherstburg.

THE INSTITUTE OF FUEL.—The Council of the Institute of Fuel invites competition for a Medal, together with a prize of books or instruments to the value of £5, to be awarded annually for a paper submitted by a Student Member of the Institute. The paper must deal with some subject relating to the preparation or utilisation of fuel or allied subjects which comes within the purview of the activities of the Institute. It must be limited to a maximum content of 10,000 words, and may be illustrated by line drawings or photographs.

THE MODEL ENGINEER.—We should like to offer our hearty congratulations to our little contemporary, the "Model Engineer," on the appearance yesterday of its 1500th number. It has consistently maintained a high standard and has done more than can be estimated to keep model-making on the level of real mechanical engineering in miniature. Mechanical model-making is an ancient art and a very useful one, and it deserves to have as good an organ as it has had for the past thirty-two years in Messrs. Percival Marshall and Co.'s publications.

COMPETITION FOR AGRICULTURAL MACHINES.—The competition for agricultural machines—*Concours d'orientation de la mécanique appliqué à l'industrie du sol*—which was held at Lausanne last September under the auspices of the Institut International de Mécano-Culture, was such a success that it has decided to hold another competition at the same place in September next. Last year there were 37 entrants and three prizes and 5 honourable mentions were awarded. The subject of this year's competition will be the same as that of the last, namely, the production of a machine which is capable of performing all the work on a small farm of some 15 hectares—say 47 acres. Full particulars may be had on application to the Secrétariat de l'Institut International de Mécano-Culture, 3, Rue Pichard, Lausanne, Switzerland.

JOHN MORRIS MEMORIAL.—A suggestion has been made by a large number of friends of the late Mr. John Morris that some action should be taken to provide a permanent memorial as an expression of their great regard and appreciation of his life's work at the Royal Technical College, the Salford Technical and Engineering Association, and the social and religious organisations in Salford, with a view to the establishment of a capital sum, the interest of which would be used for a John Morris Memorial Prize. After careful consideration, it has been decided that a prize or prizes shall be awarded annually to the student or students of the Engineering Department of the Royal Technical College whose work and examination results during the Evening Courses for the Ordinary National Certificate—a course occupying three years—show the greatest merit. Details of this scheme will be settled later in consultation with the Education Committee and the Principal of the College. Any who desire to be associated with this project are invited to send a subscription to the Treasurer of the Fund, Mr. Richard Halliday, 239, Walkden-road, Worsley.

CONGRESS OF MINING, METALLURGY AND APPLIED GEOLOGY.—The Sixth International Congress of Mining, Metallurgy and Applied Geology will be held at Liége from June 22nd to 28th, inclusive, next. It will take place under the patronage of His Majesty King Albert I., and of the Belgian Government. The organisation will be carried out under the direction of l'Association des Ingénieurs sortis de l'Ecole de Liége (A.I.Lg.) and of the Société Géologique de Belgique at Liége by agreement with the societies named at the Düsseldorf Congress. The Congress will consist of three sections: I., Mining; II., Metallurgy; III., Applied Geology. Each section may be divided into groups or sub-sections. The official language of the Congress will be French. Further particulars may be obtained on application to Monsieur O. Lepersonne, General Secretary of the Organising Committee, 16, Quai des Etats-Unis, Liége, Belgium. A certain number of excursions will be organised in connection with the meeting. It is expected that they will include (*a*) a visit to the principal mines of Campine and to the mining districts of Liége and Hainaut and elsewhere in Belgium; (*b*) a visit to the metallurgical works of Belgium and, if possible, to those of Luxemburg, including inspection of the important laboratories of metallography, and (*c*) visits to the Campine, to the iron ore mines of Couthuin and to limestone and dolomite quarries of the district, to the manganese mines of the valley of La Lienne and to the mineral springs of Chevron.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	19/6 to 21/–
(1) Spanish	21/6 to 23/–
N.E. COAST—	
Native	18/– to 21/–
Foreign (c.i.f.)	22/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	4 1 0	—
No. 1 Foundry	4 0 6	—
No. 3 Foundry	3 18 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 18 0	3 18 0
No. 1	3 18 6	3 18 6
Cleveland—		
No. 1	3 15 0	3 15 0
Silicious Iron	3 15 0	3 15 0
No. 3 G.M.B.	3 12 6	3 12 6
No. 4 Foundry	3 11 6	3 11 6
No. 4 Forge	3 11 0	3 11 0
Mottled	3 10 6	3 10 6
White	3 10 6	3 10 6
MIDLANDS—		
(3) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 15 6	—
„ „ Foundry	3 19 6	—
(3) Northampton—		
Foundry No. 3	3 15 0	—
Forge	3 11 0	—
(1) Derbyshire—		
No. 3 Foundry	3 18 6	—
Forge	3 14 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 13 6	—
No. 4 Forge	3 9 6	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 9 6 (*a*); 4 11 6 (*b*); 4 15 0 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 15 0	—
Second Quality Bars	9 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	11 0 0	—
Best Bars	11 10 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	10 0 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0 to 9 5 0	—
Gas Tube Strip	11 2 6	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 0 0	10 0 0
Ship Plates, ¾in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	9 0 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	13 0 0	12 7 6

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 10 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
„ (Small Round)	8 5 0 to 8 7 6	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	10 0 0	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	6 15 0	—
Hoops	9 15 0 to 10 5 0	—
Soft Wire Rods	8 0 0	—
MIDLANDS—		
Small Rolled Bars	8 0 0 to 8 15 0	—
Billets and Sheet Bars	6 2 6 to 6 12 6	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	11 15 0 to 12 0 0	—
Angles	8 7 6	—
Joists	8 10 0	—
Tees	9 7 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 12 6	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/6 to 18/9
Block Tin (Cash)	176 15 0
„ (three months)	179 15 0
Copper (cash)	72 15 0
„ (three months)	69 0 0
Spanish Lead (cash)	21 11 3
„ „ (three months)	21 12 6
Spelter (cash)	19 12 6
„ (three months)	20 6 3
MANCHESTER—	
Copper, Best Selected Ingots	77 17 6
„ Electrolytic	84 10 0
„ Strong Sheets	110 0 0
„ Tubes (Basis Price), lb.	0 1 3
Brass Tubes (Basis Price), lb.	0 1 1
„ Condenser, lb.	0 1 3
Lead, English	23 2 6
„ Foreign	21 12 6
Spelter	20 7 6
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	3/4½ per lb.	
Ferro Tungsten	3/1½ per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 7 6	7/6
„ „ 6 p.c. to 8 p.c.	£22 10 0	7/–
„ „ 8 p.c. to 10 p.c.	£22 0 0	7/–
„ „ Specially refined		
„ „ Max. 2 p.c. carbon	£33 10 0	10/–
„ „ „ 1 p.c. carbon	£39 0 0	15/–
„ „ „ 0·70 p.c. carbon	£41 10 0	15/–
„ „ „ carbon free	11d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£13 15 0 for home; £13 10 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/– per unit	
„ „ 75 p.c.	£19 0 0 scale 7/– per unit	
„ Vanadium	12/10 per lb.	
„ Molybdenum	4/2 per lb.	
„ Titanium (carbon free)	9d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS

SCOTLAND.

(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	14/–
„ „ Ell	16/–
„ „ Splint	17/– to 18/–
„ „ Trebles	15/–
„ „ Doubles	13/6 to 13/9
„ „ Singles	13/6
AYRSHIRE—	
(f.o.b. Ports)—Steam	14/6
„ „ Jewel	17/6
„ „ Trebles	14/6
FIFESHIRE—	
f.o.b. Methil or Burntisland—Steam	13/– to 14/6
Screened Navigation	18/– to 19/6
Trebles	15/6 to 16/6
Doubles	13/6 to 14/–
Singles	13/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	14/6
Secondary Steam	14/–
Trebles	15/–
Doubles	13/–
Singles	13/6

ENGLAND.

	Inland.	Export.
(8) N.W. COAST—		
Steams		21/6 to 23/–
Household		38/– to 51/–
Coke		26/–
NORTHUMBERLAND—		
Best Steams		16/6 to 16/9
Second Steams		15/6
Steam Smalls		11/– to 11/6
Unscreened		13/– to 13/6
Household		25/– to 37/–
DURHAM—		
Best Gas		16/9
Second		15/6 to 15/9
Household		25/– to 37/–
Foundry Coke		25/– to 30/–
SHEFFIELD—		
Best Hand-picked Branch	26/6 to 28/–	—
Derbyshire Best Bright House	21/– to 23/–	—
Best House Coal	20/6 to 21/6	—
Screened House Coal	18/6 to 20/–	—
„ „ Nuts	16/6 to 18/–	—
Yorkshire Hards	15/6 to 17/–	—
Derbyshire Hards	15/6 to 17/–	—
Rough Slacks	9/– to 10/–	—
Nutty Slacks	7/6 to 8/6	—
Smalls	3/– to 5/–	—
Blast-furnace Coke (Inland)	17/– on rail at ovens	
Furnace and Foundry Coke (Export), f.o.b.		22/6 to 23/–

(9) SOUTH WALES.

CARDIFF—	
Steam Coals :	
Best Smokeless Large	20/– to 20/3
Second Smokeless Large	18/9 to 20/–
Best Dry Large	19/9 to 20/–
Ordinary Dry Large	19/– to 19/6
Best Black Vein Large	18/6 to 18/9
Western Valley Large	18/3 to 18/6
Best Eastern Valley Large	18/– to 18/3
Ordinary Eastern Valley Large	17/9 to 18/–
Best Steam Smalls	14/9 to 15/–
Ordinary Smalls	13/6 to 14/6
Washed Nuts	19/6 to 28/–
No. 3 Rhondda Large	21/– to 21/6
„ „ Smalls	15/6 to 16/–
No. 2 „ Large	17/3 to 17/6
„ „ Through	15/6 to 16/6
„ „ Smalls	14/6 to 15/–
Foundry Coke (Export)	32/6 to 37/–
Furnace Coke (Export)	29/– to 30/–
Patent Fuel	22/– to 22/6
Pitwood (ex ship)	26/6 to 26/9
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	36/– to 38/–
Seconds	30/– to 32/6
Red Vein	26/– to 28/–
Machine-made Cobbles	42/6 to 45/–
Nuts	45/– to 46/6
Beans	25/6 to 28/–
Peas	20/– to 20/6
Breaker Duff	10/9 to 11/3
Rubbly Culm	12/6 to 13/–
Steam Coals :	
Large	20/– to 21/–
Seconds	18/6 to 19/6
Smalls	13/6 to 15/–
Cargo Through	15/6 to 16/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate : Joists (minimum), 12/6; Ordinary Ship, Bridge, and Tank Plates and Sections, 10/– if home consumers confine purchases from associated British Steel Makers.

French Engineering Notes.

(From our Correspondent in Paris.)

Steel Organisation.

THE situation of the steel trade on the Continent is sufficiently precarious to bring home to producers the necessity of modifying the organisation of the industry in the direction of enabling it to deal more satisfactorily with outside competition and to ensure a distribution of business and a maintenance of prices. There is an over-production which cannot be absorbed. There is also more steel offered by the United States, and that is regarded as the most disquieting factor. The British organisation for steel exports is another matter that shows the need for prompt action. It is fully recognised that the Steel Cartel must be renewed, but it can only operate on a much larger basis, whereby there will be included a system of work distribution and a control of prices. Before that could be accomplished each country would be obliged to carry out its own national organisation. In France, the Comité des Forges has all the elements in hand for unifying action, and the only thing remaining to be done is to form a Sheet Comptoir, negotiations for which have been hanging fire for some considerable time. In Belgium the national steel organisation has recently been completed, and in Germany the various producers' associations have been renewed after much trouble, the difficulty being, in all cases, the fixing of quotas amongst mill owners. The Executive Committee of the Steel Cartel has held several meetings, at which progress was made with negotiations, and at a final meeting in Paris on February 1st it was decided to constitute, from that date, international sales comptoirs for a period of six months, by which time it is hoped that the permanent comptoir will be formed. The general arrangement will be somewhat similar to that which was recently put in operation in Belgium. It applies to partly manufactured steel, girders, merchant bars, plates and hoops. As export prices are regarded as unremunerative, another meeting will be held in Brussels to revise them. For the time being orders may continue to be received by makers, who must communicate them to the comptoirs, and the latter may pass them on to other producers if the manufacturers receiving them should have already reached their quotas. Eventually all the business will be centralised by the comptoirs. The effect of this arrangement is to suppress individual initiative and to leave the comptoirs masters of the home and foreign markets, thereby cutting out competition amongst producers themselves and giving to the comptoirs a free hand to meet competition outside.

Shipbuilding.

The prospect of a limitation of naval armaments is adding to the difficulties of shipbuilders, and as more is known of the causes of those difficulties the less appear to be the chances of finding a way out of them. The whole matter has been dealt with in and out of Parliament, and the only hope lies now in the Conseil National Economique being able to offer a satisfactory solution. There are seventeen shipyards capable of building 400,000 tons a year. It is declared that they have been working at less than 25 per cent. of their capacity. One of the leading shipping companies has explained why it was obliged to order a cargo boat in England. It could only obtain one French quotation, which was just double that of the English, and while a Norwegian tender was about the same as the English, a longer time was asked for delivery, and the German prices were 12 per cent. higher. The situation is no doubt being placed purposely in as unfavourable a light as possible in the hope that Government will be obliged to institute a new policy which will give effective aid to the shipbuilding industry, and there is no doubt that that will be done, although only as a consequence of a reorganisation of the shipyards in the way of specialisation. That will involve a programme of merchant shipbuilding, and it may therefore be expected that the final result will be a renewal and extension of the French mercantile fleet.

Industrial Charges.

What is known as the social insurance scheme has met with more opposition than any other measure that has been enacted for the benefit of workmen, merely because it was evolved without any consideration being given to the effect it was likely to have on industry generally. It was to have been put in operation last year, but the difficulties in the way of its application were so great that the measure had to be postponed for amendment. Then it was officially stated that the scheme would come into operation this month. Immediately, there were reports of advancing prices, while, in one case, men actually struck for an increase in wages equal to the amount that would have to be retained for insurance. The Government again withdrew the Bill for further amendment, although preparations are being made to carry the scheme through at the earliest date. The trouble with all these social measures is that the men usually succeed in loading all the burden on the employer, who is obliged to pass on some of it, if he can, to the consumer.

Trade Returns.

The returns of foreign trade for 1929 show a further adverse balance, which is attributable to heavy increases in the imports of raw material and manufactured goods and to the all-round decline of exports. The development of imports, is, of course, largely due to the quantity of material supplied by Germany for reparations and to the larger purchases of coal. In the exports of manufactured goods there was a small increase in weight, but a heavy contraction of values. The imports during 1929 totalled 58,284 million francs, an increase on the previous year of 4849 million francs. The values of exports were estimated at 50,072 million francs, a decline on the total for 1928 of 1302 million francs. The imports of manufactured goods amounted to 2,115,037 tons and the exports to 5,359,638 tons.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

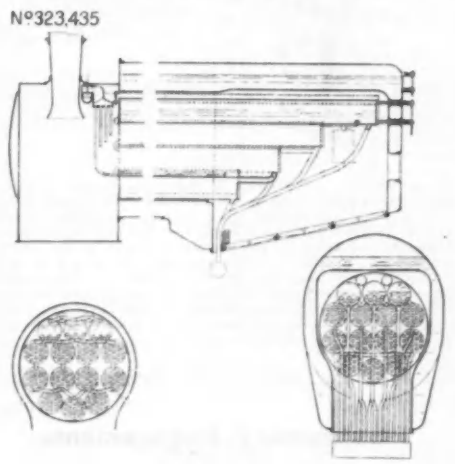
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

323,435. October 11th, 1928.—STEAM GENERATORS, J. Mouchly, Palestine Railways, Haifa, Palestine.

The essence of this specification, which is rather involved, seems to be covered in the following paragraph: "Such a construction of nested steam generating elements has the advantage that instead of there being two large tube plates to deal with, they are divided up into a number of small tube plates of the same material as the whole elements. Moreover, the steam

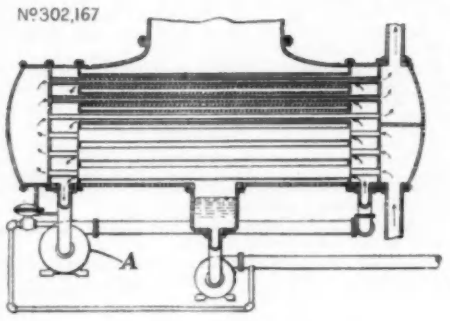


generating elements or drums may comprise, owing to their size, solid-drawn steel tubes terminating in welded tube plates having welded smoke tubes. This, therefore, permits of a standardised construction of steam generator which is readily prepared and wherein the steam generating elements are interchangeable. In the case where there is damage to one of the steam generating drums or elements, it may be bodily removed and replaced by another, thus preventing delay in continuity of operation."—*January 2nd*, 1930.

CONDENSERS AND FEED-WATER HEATERS.

302,167. December 10th, 1928.—STEAM CONDENSERS, The British Thomson-Houston Company, Ltd., Crown House, Aldwych, London, W.C. 2.

The object of this invention is to prevent the access of circulating water, in surface condensers, to the steam space, which

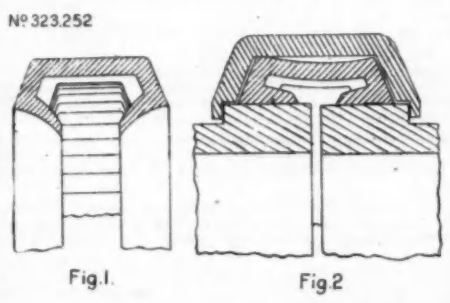


would contaminate the condensate. So the inventors surround the circulating tubes with other tubes and circulate pure water through the annular space. Then, if a leakage does occur, it is only the pure water which finds its way into the steam space. The drawing shows the pump for circulating the clean water at A.—*January 2nd*, 1930.

TRANSMISSION OF POWER.

323,252. September 18th, 1928.—PIPE JOINTS, D. H. B. Reynolds, Lygantano, Battlefield-road, St. Albans.

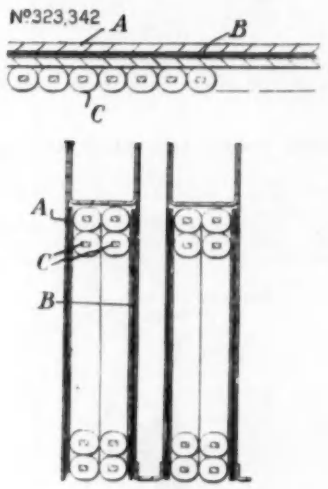
This invention relates to that form of pipe joint which is



characteristic of the hydraulic cup leather. The general scheme of the joint is shown in the illustration, and in connection therewith the inventor remarks that in some cases the "extreme edges of the flanges [of the sealing member] are in some cases drawn away from the surface of the pipe, the flanges becoming immersed in any fluid that may be present, so that the pressure of said fluid is equal and opposite, and is thus unable to contribute in any way to the sealing of the joint." As a consequence, he so forms the jointing ring—as shown in Fig. 1—that the lip has a definite tendency, when put in place, to keep contact with the pipe to which it is applied. The general arrangement of the joint when completed is shown in Fig. 2.—*December 18th*, 1929.

323,342. December 6th, 1928.—LIGHTNING OR SURGE ABSORBERS, Eric Douglas Tobias Norris and Ferranti, Ltd., of Hollinwood, Lancaster.

A very serious difficulty arises in connection with surge absorbers in that the line current through the line winding under normal operating conditions—*e.g.*, at 25 or 50 cycles per second periodicity—sets up eddy current losses in the associated metallic element. For the heavier currents these losses become serious, and are difficult and expensive to dissipate. The invention has for its object the elimination or reduction of these losses. The drawing shows the invention applied to the usual cylindrical

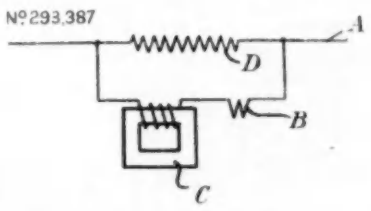


form of surge absorber, embodying a cylindrical metallic element A acting as an energy dissipator. One or more turns of split cylinders B of thin conducting magnetic or non-magnetic material are provided between the line coils C, and the energy dissipator A, the individual turns or cylinders being insulated from one another. The curved sheets are conveniently formed of Stalloy or silicon iron, such as is used for modern transformer cores, and although highly insulated from the coils may be lightly insulated from the casing. With this arrangement, the flux is divided between the various sheets or turns of the sheet, and the loss is very much reduced.—*January 2nd*, 1930.

MEASURING AND TESTING INSTRUMENTS.

293,387. June 21st, 1928.—ARRANGEMENTS FOR INCREASING THE SENSITIVENESS OF ALTERNATING-CURRENT INSTRUMENTS, *Siemens-Schuckertwerke Aktien-Gesellschaft, of Berlin-Siemensstadt, Germany.*

The invention relates to an arrangement for increasing the sensitiveness of alternating current measuring or indicating instruments, or alternating-current relays. For this purpose, an inductance containing iron in the magnetic circuit is connected in series with the indicating instruments or relay. The actuating potential then forms the vector sum of the potential acting on the instrument, and the series potential of the choking coil. In the diagram the current fluctuations of alternating-current mains A are to be transmitted on an amplified scale on to the measuring instrument or relay B, represented by its setting resistance. A choking coil C containing iron is connected in series to the instrument B. An ohmic resistance D is con-



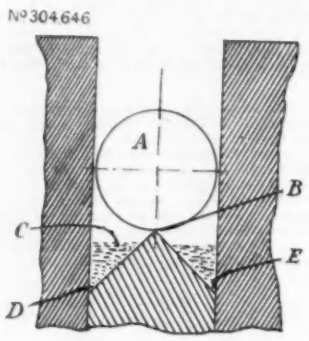
nected in parallel to both. When this parallel resistance D is small with respect to the sum of the resistance of the choking coil, and of the instrument B, the potential on the resistance D is proportional to the current in the line A and the current fluctuations on the line are amplified on the instrument B. The setting resistance B of the measuring instrument or relay can be formed by the resistance of the instrument or also by supplementary resistances connected as desired with respect to the instrument. The constant setting resistance may be an ohmic resistance, or inductive or capacity resistances, or any desired combination of these three kinds may also be used. It may be advisable, by the addition of capacity, to tune the measuring or relay circuit or the whole circuit to the frequency of the feeding alternating potential in order to suppress or make ineffective in their action on the measuring instrument or relay any harmonic oscillations in the iron enclosed current circuit of the choking coil.—*December 23rd*, 1929.

FURNACES.

304,646. September 21st, 1928.—ELECTRIC FURNACES, Heraeus Vacuumschmelze Aktiengesellschaft and Hans Hiemenz, all of Hanau am Main, Germany.

This invention relates to electrically-heated annealing furnaces. Suggestions have been made to heat electric furnaces by means of coils of a heat refractory metallic material placed into niches or recesses of the heating chamber. In furnaces heated in this manner undesirable particles, such as, for example, oxide scales from the heated charge, frequently accumulate at the bottom of the furnace, and in the recesses or niches in which the heating coils are accommodated. Where such particles collect the transmission of heat is reduced and the collection of such particles is liable to cause damage to the heating element

According to this invention, at the bottom of the furnace there are recesses, the bottoms of which are formed of roof-shaped stones, the heating elements A, preferably in the form of coils,

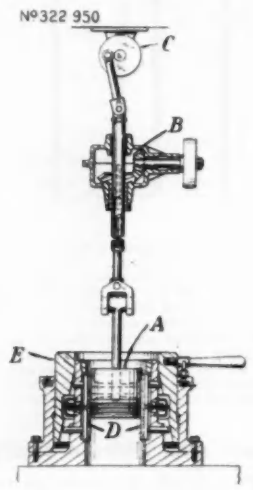


being placed upon the apices B. Foreign matter, such as dust and oxide scales C collects in the cavities D and E.—*December 23rd*, 1929.

MACHINE TOOLS AND SHOP APPLIANCES.

322,950. February 11th, 1929.—A Machine for Honing Pistons, Clement Talbot, Ltd., and P. E. Knell, Barlby-road, London, W. 10.

The inventors propose to impart a highly finished surface to such machine parts as engine pistons by a process of honing. In the illustration the piston is shown at A, assembled with its

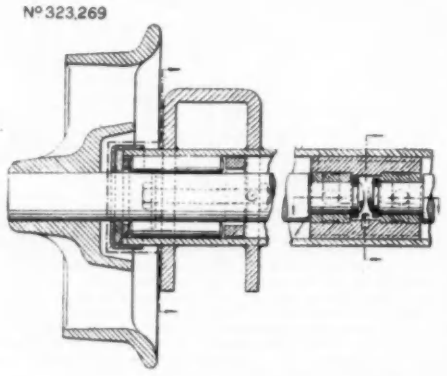


connecting-rod and connected with the gearing B, which gives it a rotary motion, while the crank C reciprocates it. Two hones are shown at D D, but the inventors say that they prefer to use three hones equally spaced round the circumference. The hones are mounted in a substantial casing, and can be adjusted by the wedge-shaped ring E.—*December 19th*, 1929.

TRAMWAYS AND RAILWAYS.

323,269. September 29th, 1928.—Wheel Axle and Bearing Arrangements for Railway Vehicles, W. S. Hudson and E. Hudson, 38A, Bond-street, Leeds.

It would appear that an endeavour is made in this invention to overcome the differential action of railway wagon wheels in

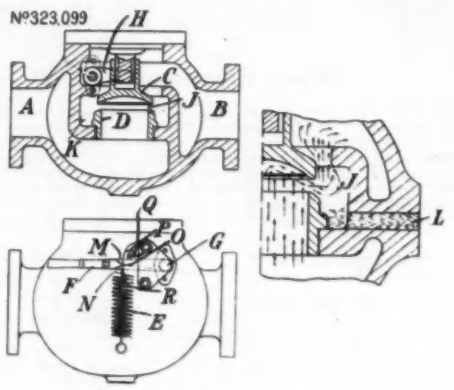


passing curves. The inventors fix the wheels on stub axles, which may run in roller bearings, as shown, and towards the inner ends of the two half axles there are other bearings to take up end thrust. The whole assembly is mounted in a tube, which forms an exterior axle.—*December 30th*, 1929.

MISCELLANEOUS.

323,099. December 1st, 1928.—Steam Separators, Cockburns, Ltd., and Donald MacNicholl, both of Clydesdale Engineering Works, Cardonald, near Glasgow.

This specification describes an improved steam separator presenting a convergent-divergent passage in which the throat is constituted by the gap between a valve and valve seat, the valve being loaded towards its seat to give a predetermined pressure difference between the inlet and outlet, the arrangement being such that the valve floats with an opening proportionate to the steam consumption. The separator is designed to ensure constant throat velocity irrespective of steam consumption, which in turn means that the throat area is variable in accordance with consumption requirements. The steam separator comprises a valve chest having an inlet A and an outlet B, communication between which is controlled by a valve C engageable with the seat D. The valve is loaded by a helical tension spring E influencing a lever F secured to a spindle G journaled in the chest and carrying a bifurcated arm H engaging the back of the valve. The throat of the separator is constituted by the gap J between the seat and the valve when the valve is open. Concentric with the throat is an annular channel K into which is projected water thrown out from the steam and whence the water may drain to a steam trap by way of a passage L in the wall of the chest, the flow through the throat being indicated



by the arrows. The lever F carries an index finger M adapted to register, respectively, with marks, N, O and P, on a plate mounted on the chest when the valve is in shut position, in the intermediate position and in fully lifted position, Q denotes a stopper pin penetrating an orifice in the plate R and engageable normally by the top edge of the lever F in order to limit the opening movement of the valve. On withdrawal of the pin Q the lever F may be lifted manually to open the valve further, in which fully lifted position the lever masks the orifice in the plate R, it being thus impossible to re-insert the pin until the lever is lowered.—*December 24th*, 1929.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME and PLACE at which the meeting is to be held should be clearly stated.

TO-DAY.

Chemical Engineering Group.—Joint meeting with Birmingham Section. Visit to the Landor-street works and, if time permits, the works of the General Electric Company, Ltd. 2.15 p.m. In the Chamber of Commerce, New-street, Birmingham. "Electric Furnaces for Heat Treatment," by Mr. A. G. Lobley. 6.30 p.m.

Institute of Fuel.—The Engineers' Club, Albert-square, Manchester. "The Fundamental Problems of Flue Gas Purification," by Professor M. W. Travers, F.R.S. 7 p.m.

Junior Institution of Engineers.—39, Victoria-street, S.W. 1. Ordinary meeting. Honorary members' lecture, "Co-operation between Technical Education and Industry," by Mr. G. F. O'Riordan. 7.30 p.m.

Royal Institution of Great Britain.—21, Albemarle-street, Piccadilly, W. 1. Discourse, "Diving," by Dr. Leonard Hill, F.R.S. 9 p.m.

MONDAY, FEBRUARY 10TH.

Institute of Metals: Scottish Local Section.—In the Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. "Pyrometry," by Mr. S. H. Hawkins. 7.30 p.m.

Railway Club.—57, Fetter-lane, London, E.C. 4. Annual general meeting. Presidential address. 7.30 p.m.

Surveyors' Institution.—12, Great George-street, S.W. 1. "The Rating and Valuation (Apportionment) Act, 1928," by Mr. J. Logie Milne. 8 p.m.

TUESDAY, FEBRUARY 11TH.

Institute of Marine Engineers.—85–88, The Minories, E.C. 3. An Informal Discussion on "Machinery for Future High-Powered Atlantic Liners." Mr. J. Hamilton Gibson will lead the discussion in favour of Steam, to be followed by Mr. J. Calderwood on behalf of Diesel Engines. 6.30 p.m.

Institute of Metals: North-East Coast Local Section.—In the Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "Electric Heating," by Mr. W. Richardson. 7.30 p.m.

Institution of Civil Engineers.—Great George-street, Westminster, S.W. 1. Paper to be submitted for discussion, "The Diversion of the River Ashop," by Mr. R. W. Scott Thompson. 6 p.m.

Institution of Electrical Engineers: North Midland Centre.—The Hotel Metropole, Leeds. "The Jet-wave Rectifier: The Experimental and Theoretical Basis of its Design," by Dr. J. Hartmann. 7 p.m.

Institution of Electrical Engineers: Scottish Centre.—The Royal Technical College, Glasgow. Fourth ordinary meeting. "The Visit of the Institution to France," by Mr. W. B. Hird. 7.30 p.m.

Institution of Petroleum Technologists.—At the House of the Royal Society of Arts, John-street, Adelphi, London. "The Oilfields of Alberta," by Mr. E. H. Cunningham Craig. 5.30 p.m.

Manchester Geological and Mining Society.—Queen's Chambers, 5, John Dalton-street, Manchester. Presidential address, by Mr. James Gardiner. 4 p.m. The Council will meet at 3 p.m.

Royal Institution.—21, Albemarle-street, W. 1. "X-ray Determination of the Structure of Cellulose," by Sir William Bragg, F.R.S. 5.15 p.m.

Sheffield Metallurgical Association.—198, West-street, Sheffield. "A Review of the Effects of Cold Work on the Physical Properties of Steel," by Mr. F. S. Merrills. 7.30 p.m.

WEDNESDAY, FEBRUARY 12TH.

Institute of Fuel.—At the Rooms of the Chemical Society, Burlington House, Piccadilly, W. 1. "Submerged Combustion," by Mr. C. Featherstone Hammond. 6 p.m.

Institute of Metals: Swansea Local Section.—In the Thomas Café, High-street. "The Corrosion of Non-ferrous Metals," by Dr. A. G. Ramsay. 7 p.m.

Institution of Civil Engineers.—Great George-street, Westminster, S.W. 1. Informal meeting. Subject for discussion, "The Influence of the Progress of Aeronautical Engineering on other Branches of Engineering Work," by Mr. Lucien Alphonse Legros. 6 p.m.

Institution of Engineers-in-Charge.—St. Bride Institute, Bride-lane, Fleet-street, E.C. 4. "The Water Supply of the Metropolis," by Mr. H. E. Stilgoe. 7.30 p.m.

THURSDAY, FEBRUARY 13TH.

British Association of Refrigeration.—The Hall of the Institution of Mechanical Engineers, Storey's-gate, St. James's Park, London, S.W. 1. Adjourned discussion of Mr. B. C. Oldham's paper (read on January 9th, 1930) on "Some Considerations in Design of Modern Refrigerating Plant." 5.30 p.m.

Institute of Marine Engineers: Junior Section.—The Minories, E.C. 3. "Discipline as Applied to the Engine-room, &c.," by Mr. S. N. Kent. 6.30 p.m.

Institute of Metals: London Local Section.—In the Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W. 1. "Temperature Measurement and Control in Works," by Mr. H. H. Smith. 7.30 p.m.

Institution of Electrical Engineers.—In the Lecture Theatre of the Institution, Savoy-place, Victoria Embankment, W.C. 2. Ordinary meeting. "The Jet Wave Rectifier: The Experimental and Theoretical Basis of its Design," by Dr. J. Hartmann, to be illustrated by a cinematograph film. 6 p.m.

Institution of Mining and Metallurgy.—At the Rooms of the Geological Society, Burlington House, Piccadilly, W. 1. Paper to be submitted for discussion, "The *Rôle* of Chemical Engineering in Mining and Metallurgy," by Professor W. E. Gibbs. 5.30 p.m.

Junior Institution of Engineers.—Visit to works of Walters' Palm Toffee, Ltd. 2.30 p.m.

Optical Society.—At the Imperial College of Science and Technology, South Kensington, S.W. 7. Presidential address, "Optics in Radio Transmission and in other Fresh Fields," by Mr. F. Twyman, F.R.S. 7.30 p.m.

Royal Aeronautical Society.—In the Lecture Hall of the Royal Society of Arts, John-street, Adelphi, W.C. 2. "The Progress of the Autogiro since 1925" by Senor J. de la Cierva. 6.30 p.m.

Royal Institution.—21, Albemarle-street, W. 1. "Architecture of Pre-Spanish America," by Mr. T. A. Joyce. 5.15 p.m.

FRIDAY, FEBRUARY 14TH.

Institute of Metals: Sheffield Local Section.—In the Non-Ferrous Section of the Applied Science Department of the University, St. George's-square. "Recent Developments in Measuring Instruments," by Mr. S. Matthews. 7.30 p.m.

Institution of Engineering Inspection.—At the Rooms of the Royal Society of Arts, John-street, Adelphi, W.C. 2. "Optical Aids to Engineering Inspection," by Professor A. F. C. Pollard. 5.30 p.m.

Institution of Locomotive Engineers (London).—Building of the Manchester Literary and Philosophical Society, 36, George-street, Manchester. Fourth ordinary general meeting. A paper will be read by Mr. K. W. Willans on "Water-tube Boilers Suitable for Locomotives." 7 p.m.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, Westminster, London, S.W. 1. Informal meeting. Lantern lecture, by Mr. G. Stevenson Taylor, followed by a visit to the Home Office Industrial Museum. 7 p.m.

Junior Institution of Engineers.—At 39, Victoria-street, S.W. 1. Informal meeting. Technical film, "The Manufacture of Staybrite and Stainless Steels," at the works of Thos. Firth and Sons, Ltd., with notes by Mr. J. G. Hopcraft, M.C. 7.30 p.m.

Manchester Association of Engineers.—Annual dinner, Midland Hotel. 6.45 for 7.15 p.m.

MONDAY, FEBRUARY 17TH.

Royal Society of Arts.—John-street, Adelphi, London, W.C. 2. Cantor Lectures—"Recent Improvements in Methods of Brickmaking," by Mr. Alfred B. Searle. 8 p.m.

MONDAY TO FRIDAY, FEBRUARY 17TH TO 28TH.

British Industries Fair.—Olympia and Castle Bromwich, Birmingham.

TUESDAY, FEBRUARY 18TH.

Sheffield Metallurgical Association.—198, West-street, Sheffield. "Cobalt Magnet Steels," by Mr. H. E. Kershaw. 7.30 p.m.

WEDNESDAY, FEBRUARY 19TH.

Newcomen Society.—At the Institute of Marine Engineers, Minories, E.C. 3. "Pioneer Ships of the Atlantic Ferry," by Eng.-Capt. E. C. Smith. 5.30 p.m.

Royal Aeronautical Society.—In the Lecture Hall of the Institution of Electrical Engineers, Victoria Embankment, W.C. 2. "Gliding," by Dr. Georgii. 6.30 p.m.

FRIDAY, FEBRUARY 21ST.

Institution of Civil Engineers: Birmingham and District Association.—Prince's Chambers, 16, Corporation-street, Birmingham. A visit to the British Industries Fair, Birmingham.

Junior Institution of Engineers.—39, Victoria-street, S.W. 1. Ordinary meeting. "The Application of Electric Welding to the Erection and Strengthening of Steel Structures," by Mr. E. P. S. Gardner. 7.30 p.m.

WEDNESDAY, FEBRUARY 26TH.

Junior Institution of Engineers.—Visit to the works of Barrow, Hepburn and Gale, Ltd. 2.30 p.m.

THURSDAY, FEBRUARY 27TH.

Institute of Metals: Birmingham Local Section.—In the Chamber of Commerce, New-street, Birmingham. "Creep of Metals at High Temperatures," by Mr. R. W. Bailey. 7 p.m.

FRIDAY, MARCH 7TH.

Institute of Marine Engineers.—Connaught Rooms, Great Queen-street, London, W.C. Annual dinner. 7 for 7.30 p.m.

SATURDAY, MARCH 29TH.

Finsbury Technical College Old Students' Association.—Trocadero Restaurant, London. Annual dinner.